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MANUFATURING METHODS AND TECHNOLOGY MEASURE FOR PLASTIC HOUSING--ETC(U)
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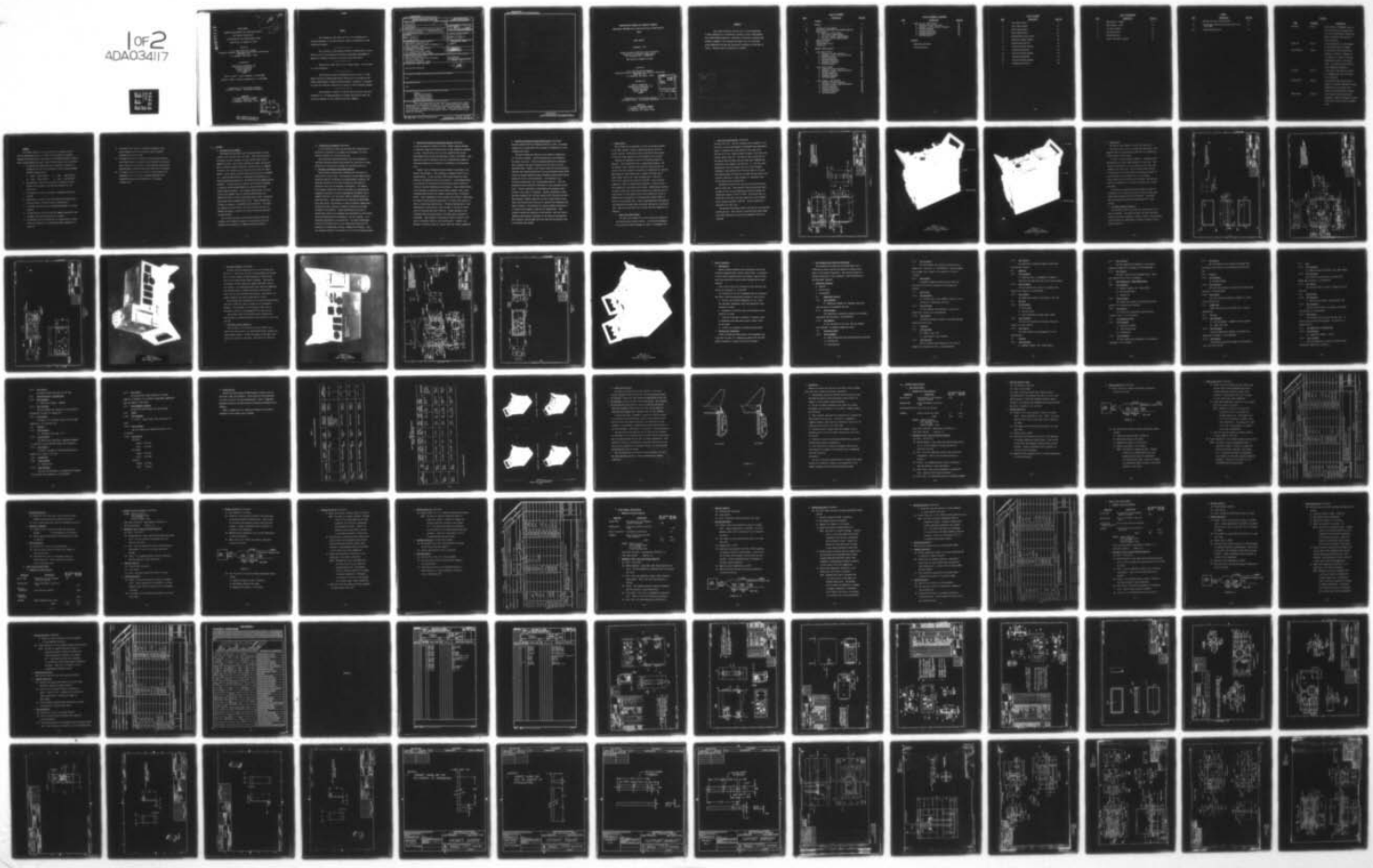

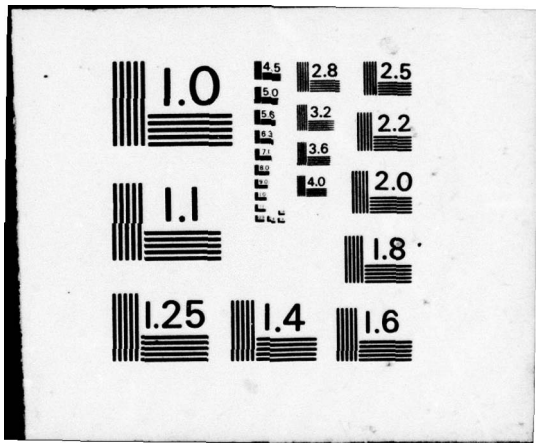
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FINAL REPORT

Manufacturing Methods and Technology Measure

For Plastic Housings For

C-2328-B-GRA-39 and C-2329-B-GRA-39 Radio

AMC Contract # DAAB05-73-C-2081

Placed By

U. S. Army Electronics Command
Production Division, Procurement and Production Directorate
DRSEL-PP-I-PI-1
Ft. Monmouth, New Jersey 07703

Prepared By

Eagle-Picher Industries, Inc.
Electronics Division
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Materials Discussion
First Article Testing
Design Modifications
Process Specifications

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the work done to prove feasibility of mass production of a non-metallic housing for the C-2328-B-GRA-39 and C-2329-B-GRA-39 Radio Set. Selection of materials, manufacturing methods, redesign of the housings and design tools are described. Cross comparisons are made and production techniques are described in detail. Quality Control procedures are included.

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MANUFACTURING METHODS AND TECHNOLOGY MEASURE

FOR PLASTIC HOUSINGS FOR C-2328-B-GRA-39 and C-2329-B-GRA-39

RADIO

FINAL REPORT

September, 1976

Object of study; Establish a pilot production capability for producing plastic cases for Army Radio Sets - AN-GRA-39B

AMC Contract # DAAB05-73-C-2081

Placed By

U. S. Army Electronics Command
Production Division, Procurement and Production Directorate
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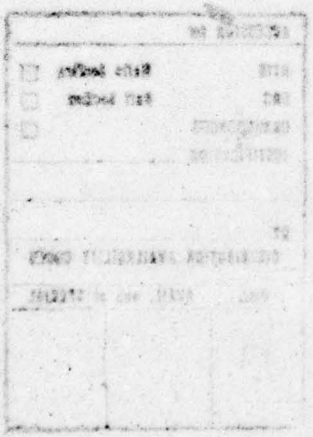
ABSTRACT

This report describes the work done to prove feasibility of mass production of a non-metallic housing for the C-2328-B-GRA-39 and C-2329-B-GRA-39 Radio Set. Selection of materials, manufacturing methods, redesign of the housings and design tools are described. Cross comparisons are made and production techniques are described in detail. Quality Control procedures are included.



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GLOSSARY

TERM	REFERENCE	DESCRIPTION
Pre-Preg	Page 4	A term given to fiberglass cloth in which the resin is introduced into the cloth at manufacture rather than added in separate step during the lay-up operation.
Lexan 101	Page 5	A trade name given to polycarbonate by the General Electric Company.
Back Pressure	Page 46	A term used in the injection mold industry to specify a pressure in the cylinder to insure an accurate temperature control of the molten resin. No pressure would result in large temperature gradients.
Pile-Ups	Page 46	A term used to describe an overflow or clogging effect when the molded part is ejected.
Plastication	Page 55	A term used in the injection mold industry to describe specified varying temperatures of the molten resin within the molding machine cylinder.
Short Shots	Page 56	A term used by the injection mold industry to describe incomplete filling of the mold cavity during the molding cycle.

PURPOSE

The primary objective of this project is to perform the production engineering required to permit the replacement of aluminum housings with molded plastic housings for the AN/GRA-39B Radio Telephone. Major accomplishments which will result from the project are as follows:

1. To provide the engineering effort required to establish a capability for pilot line production of the following AN/GRA-39B Radio Housing parts.

   A. Panel (SM-D-450185)
   B. Panel (SM-D-450179)
   C. Case (SM-D-450170)
   D. Cover (SM-D-456214)

2. Determination, design and fabrication of special tooling, special test equipment, and prototype machines for the pilot line.
3. To prepare and revise as necessary a Management Evaluation Program.
4. Application of Quality Control Procedures including Quality Control Checks of pertinent points of manufacture.
5. To design, fabricate and test engineering samples for design approval.
6. To fabricate and test First Article Samples using pilot line equipment and tooling referred to in 2 above.
7. To perform a Pilot Production Run of 25 parts each to demonstrate the capability of producing 20 radio housings per 8 hour day.

8. To prepare test reports for engineering samples, First Article samples and Pilot Production units including reworked and rejected items.

9. To submit Monthly Letter Reports, Formal Quarterly Reports and a Final Report covering the entire period of the project. Also a step by step procedure of manufacturing instructions, specifications, information and other data will be provided.

10. To prepare a General Report on Step II in accordance with paragraph 3.5.3 of Electronics Command Industrial Preparedness Procurement Requirements No. 15, Revised 3 August 1971.

I. HISTORY

A. Introduction and Summary

This Manufacturing Methods and Technology Measure has been conducted over the past three (3) years. Eagle-Picher has been involved in similar programs, the most notable being Contract DAAB05-70-C-3110. This program involved the design and development of several standard non-metallic battery cases for USAECOM. Therefore, this program was not the first of its kind for Eagle-Picher. Other similar contracts which have been done for USAECOM are: DA-28-043-AMC-02512(E), a Development and Manufacture of Advanced Engineering Models for the BB-607/U Nickel-Cadmium Battery Assembly. A similar battery container and parts were developed on Contract DA-28-043-AMC-01508(E) for the BB-610/U Nickel-Cadmium Battery Assembly. The standard sealed battery case has evolved from USAECOM Contracts DA-28-043-AMC-02361(E) and DAAB07-69-C-0406 for battery assemblies which utilize cylindrical type sealed nickel-cadmium battery cells. These programs have included for example, the BB-630/U and the BB-655/U. The metal-air standard case and transit cover have evolved from work on USAECOM development contracts for metal-air batteries BA-524/U through BA-528/U.

All of these batteries, and therefore standard cases will interface with equipment designed in accordance with the new standard line configuration, USAECOM Drawing ES-D-202410.

A. Introduction and Summary (Continued)

It can therefore be seen from the above why a manufacturer of batteries is involved in the design and development of a non-metallic housing for a military radio set.

This production engineering measure has been undertaken to establish optimized manufacturing methods for production of large quantities of non-metallic housings for the GRA/39 radio set.

B. Materials and Manufacturing Method Options

Many different manufacturing techniques are available for fabrication of radio cases. Each material and each manufacturing method has specific advantages and disadvantages; therefore, the materials selected for the radio housing case were based on production rates and environmental requirements. For example, the strongest non-metallic material available for manufacturing ruggedized containers is epoxy preimpregnated fiberglass fabric, commonly referred to as "pre-preg", which is manufacturing in a semi-cured state. This material can be procured per MIL-R-9300. After hand lay-up, the material is cured at elevated temperatures, during which time, pressure is applied to develop the ultimate strength of the material. Vacuum bag molding can be used or matched metal molds can be designed and fabricated for this process. Vacuum bag molding has the advantage of low cost tooling. It is especially applicable to low quantities. Its major disadvantage is lack of tolerance control on the vacuum bag surface and the necessity for considerable cutting, trimming and finishing. Also, the ultimate strength of the material is not fully developed because

B. Materials and Manufacturing Method Options (Continued)

of the low pressure attained by vacuum. Higher pressure molding is available using matched metal molds of high temperature aluminum or steel. Matched metal tools are more expensive than vacuum bag molding tools but precise dimensional control is attained. Also piece part price is reduced by the use of matched metal molds as less hand operations are required for finishing of the resulting part.

Another type of fiberglass molding method is available to the battery case designer. This technique is commonly referred to as premix molding. In this process, short random strands of fiberglass are interspersed within epoxy material. A pre-weighed amount of the premix is introduced into matched metal molds followed by curing at elevated temperatures and pressures. Epoxy premix molding is an extension of polyester premix molding commonly used in many fiberglass applications (for example, manufacturing of fiberglass boats). Epoxy compounding is more complex than polyester compounding and there are more manufacturing steps to be taken using epoxies in order to attain high quality parts. Polyester molding has not been considered for alkali battery cases because of its lack of resistance to potassium hydroxide solutions. Premix molding is more economical than pre-preg molding as the hand lay-up operation is eliminated. Some strength is sacrificed, however, because of the lack of continuous fibers in the resulting part. However, the material is ideally suited for smaller parts and complex geometries.

B. Materials and Manufacturing Method Options (Continued)

The main problem with the fiberglass material is that, the weight savings are not appreciable and the method of manufacture is time consuming and costly.

Injection molding was selected as the method of manufacture for the radio housings. Injection molded parts are definitely the lowest cost type. Injection molding materials are generally lower strength than epoxy fiberglass materials that have been discussed above. However, test results using the selected material indicate that injected molded parts from polycarbonate Lexan 101-SE (Lexan 101 exceed fiberglass impact strength) material was utilized because of its all around capability. This material is an unfilled polycarbonate, self extinguishing material. This compounding provides sufficient flexibility to give extremely strong parts. Various compounds of polycarbonate are available which provide a wide range of capability. Another thermoplastic which has been considered for the radio cases is PVC (Polyvinylchloride). This material, commonly known for its use in high pressure water lines, has recently been perfected for applications demanding high impact strength. This material has unique strength properties as it retains the strength at high and low temperatures. Some informal testing was conducted on this material, and test results indicated this material comparable to the selected polycarbonate. More extensive testing might have been done had the material been on the market soon enough.

C. Design Effort

Parts design was accomplished in three (3) different phases of the PEM, original concepts, engineering models and first article testing. Modifications were performed in these phases as the need became apparent as is described in this section.

Hardware was submitted in three (3) different phases for approval. These submissions were 1) Engineering Samples - Two (2) models of each component with physical charactersitics as close to the final product as possible were submitted for approval. The purpose of these samples was to assure that there was no basic design conflict for their intended use, 2) The first article test samples were tested per SCS-458. Upon successful completion, three (3) samples were submitted to verify successful completion of the first article tests. Modifications required in order to pass the first article testing are presented later in this section, 3) The purpose of the pilot production run was to demonstrate the capability of producing the required number of parts at the specified rate. Also of importance was investigating and eliminating problems which arise when starting up a production line. The pilot production line articles (25) were submitted for approval.

1. Radio Case (SM-D-435951)

The radio case changed very little during the progress of the manufacturing methods contract. All internal dimensions and tolerances remain unchanged in order to accommodate the

1. Radio Case (SM-D-435951) (Continued)

existing radio set. The wall thickness was increased to .125 in order to assure environmental requirements were maintained. Figure 1 represents the final design of the radio case. The case as in the original design is common to both the local and the remote radio set. The case is open on both the top and bottom and interfaces with the radio panel assembly and the bottom cover assembly (see Photo No. 1). The only other modification that was required was due to the increased thickness of the mounting lip on the open ends of the case. The sealing gasket for both the top panel and the bottom cover required a material of lower durometer to adequately seal the increased cross sectional area.

The material selected for the part was unfilled polycarbonate (Lexan 101). This material offers exceptional impact strength as well as good dimensional stability through the temperature ranges of -65°F to 160°F. No failures were experienced on the radio case when subjected to the extremely severe testing required by SCS-458. Item B of Photo No. 1 represents the radio case.

The manufacturing method used on the case was the injection molding process. This process is utilized where high volume with rigid dimensional accuracy and inexpensive parts are required.

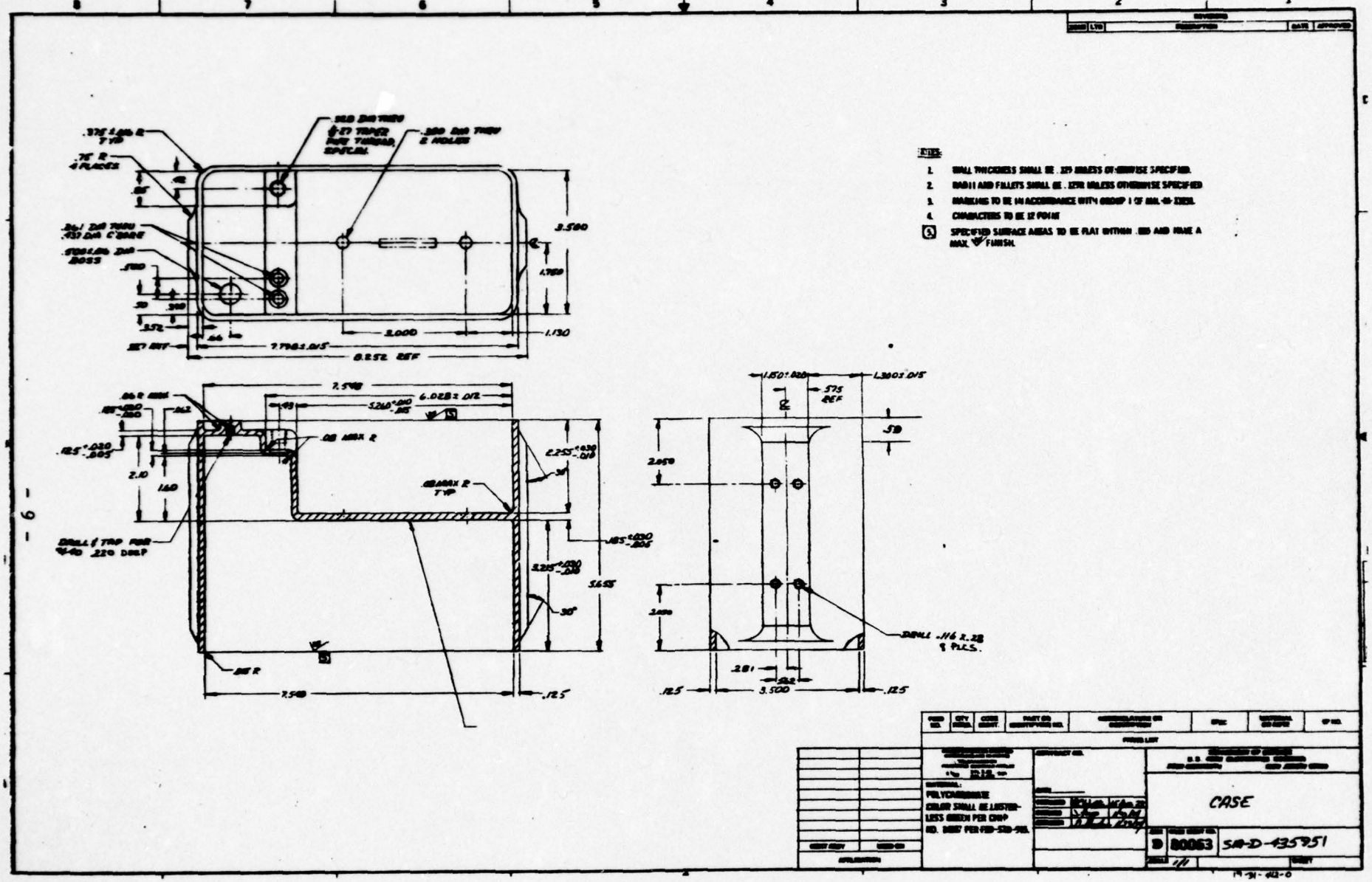
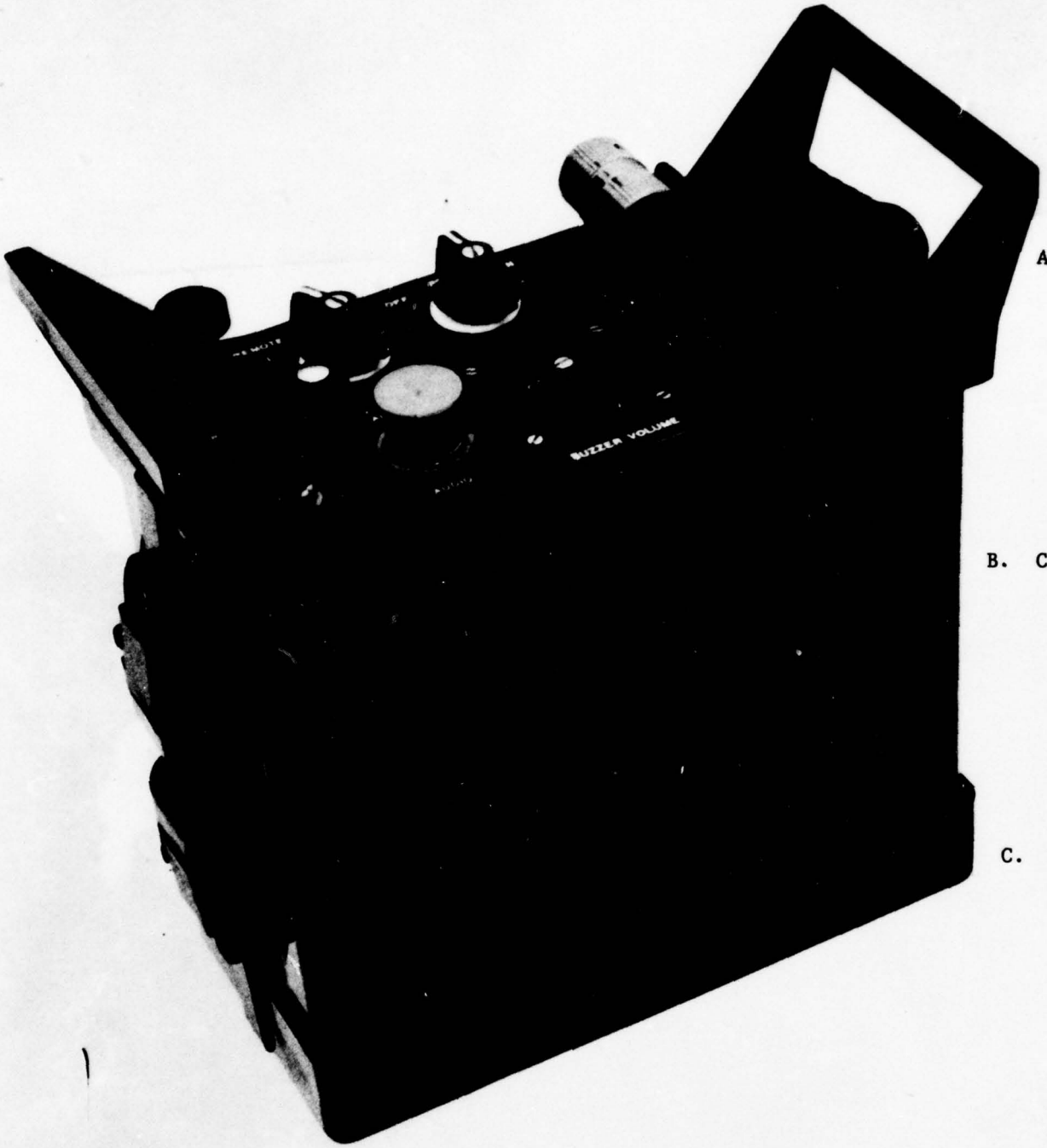


FIGURE No. 1

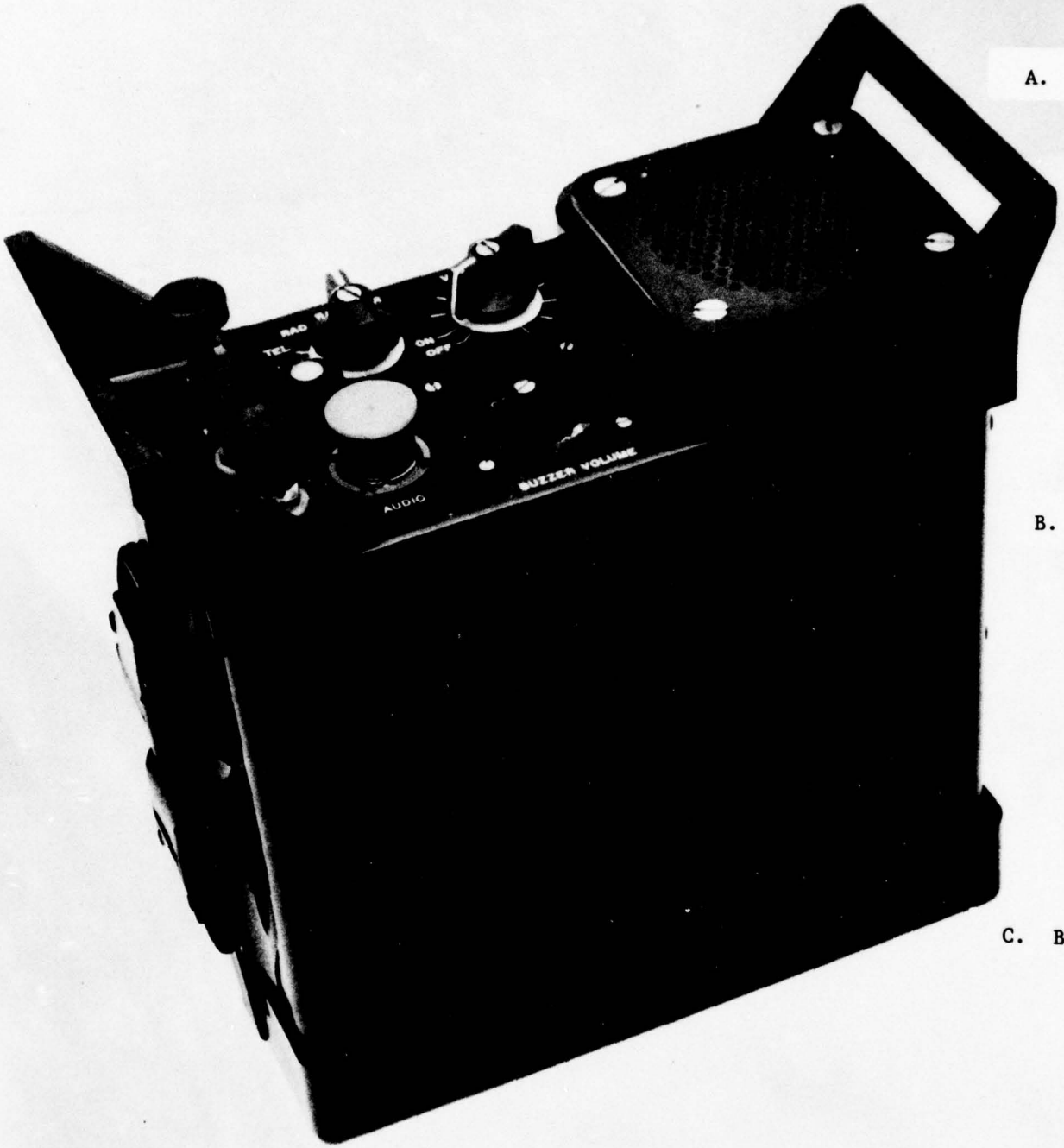


A. TOP PANEL

B. CASE

C. BOTTOM COVER

PHOTO NO. 1
GRA/39 RADIO - REMOTE
INSTALLED IN PLASTIC HOUSINGS



A. TOP PANEL

B. CASE

C. BOTTOM COVER

PHOTO NO. 2
GRA/39 RADIO - LOCAL
INSTALLED IN PLASTIC HOUSINGS

2. Bottom Cover

The bottom cover (Figure 2) (Item C of Photo No. 1).

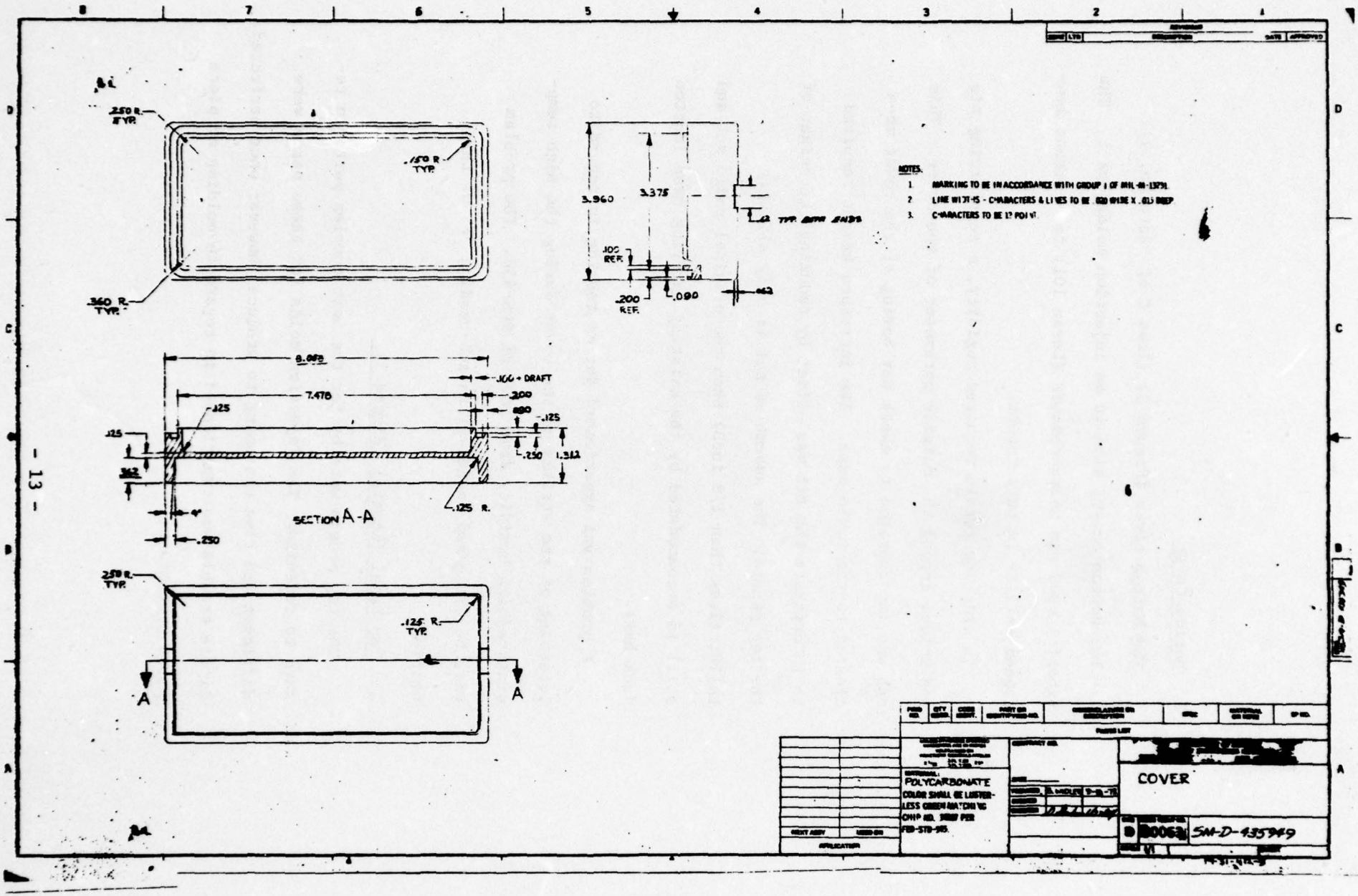
The bottom cover, also is an injection molded part. The material used was polycarbonate (Lexan 101) for reasons mentioned earlier in this report.

In order to retain required regidity, a reinforcing rib was molded around the outside parameter of the cover. This rib was incorporated to check any bowing of the cover when clamped to the radio case. The increased height required to incorporate the rib was offset by reducing the height of the top panels; The assembled set is only slightly taller (less than 1/8 inch) then the original radio set and still is accommodated by the existing carrying case (cotton duck bag).

A problem was experienced during testing in regard to loosening of the strikes on the cover during the high temperature/high humidity drop test of SCS-458. The problem will be discussed in detail in sub-heading "F" of this section.

3. Top Panel (Remote) (Figure 3)

The top panels were by far the most complex parts in regard to redesign. The injection molds for these parts were difficult and time consuming to produce, however once perfected, little trouble was experienced in regard to molding or piece parts production.


.250 R. TYP
.150 R. TYP
.360 R. TYP
3.960
3.375
.100 REF.
.200 REF.
.090
TYP. BOTH ENDS
NOTES.
1. MARKING TO BE IN ACCORDANCE WITH GROUP I OF MIL-M-13791.
2. LINE WIDTH - CHARACTERS & LINES TO BE .020 WIDE X .015 DEEP
3. CHARACTERS TO BE 12 POINT.
8.000
7.478
.100 + DRAFT
.200
.800
.125
.250
1.312
.362
.125 R.
SECTION A-A
.250 R. TYP
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POLYCARBONATE
COLOR SHALL BE LUSTER-LESS GREEN MATCHING
COVER
SM-D-435949

FIGURE NO. 2

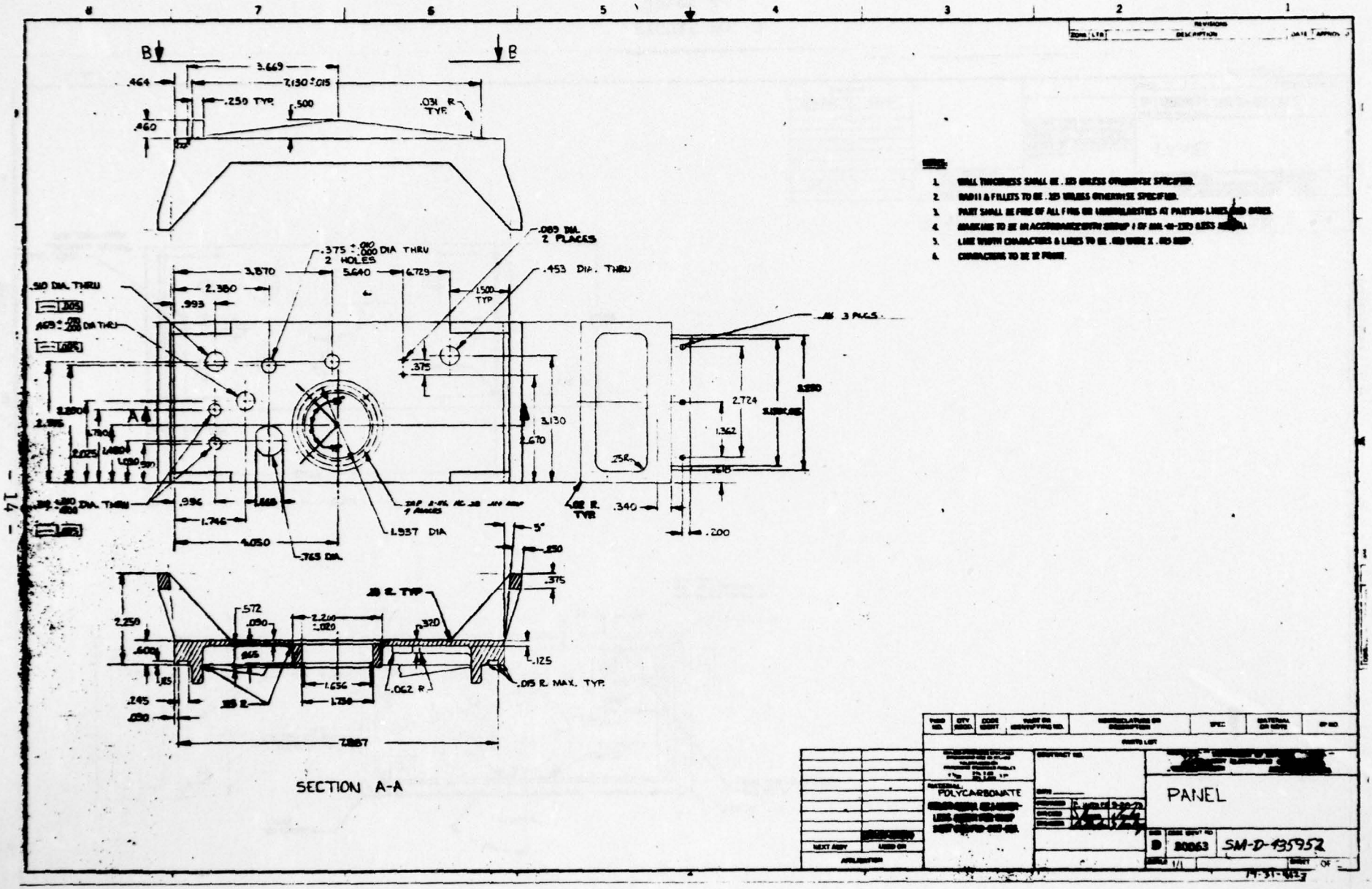

FIGURE NO. 3
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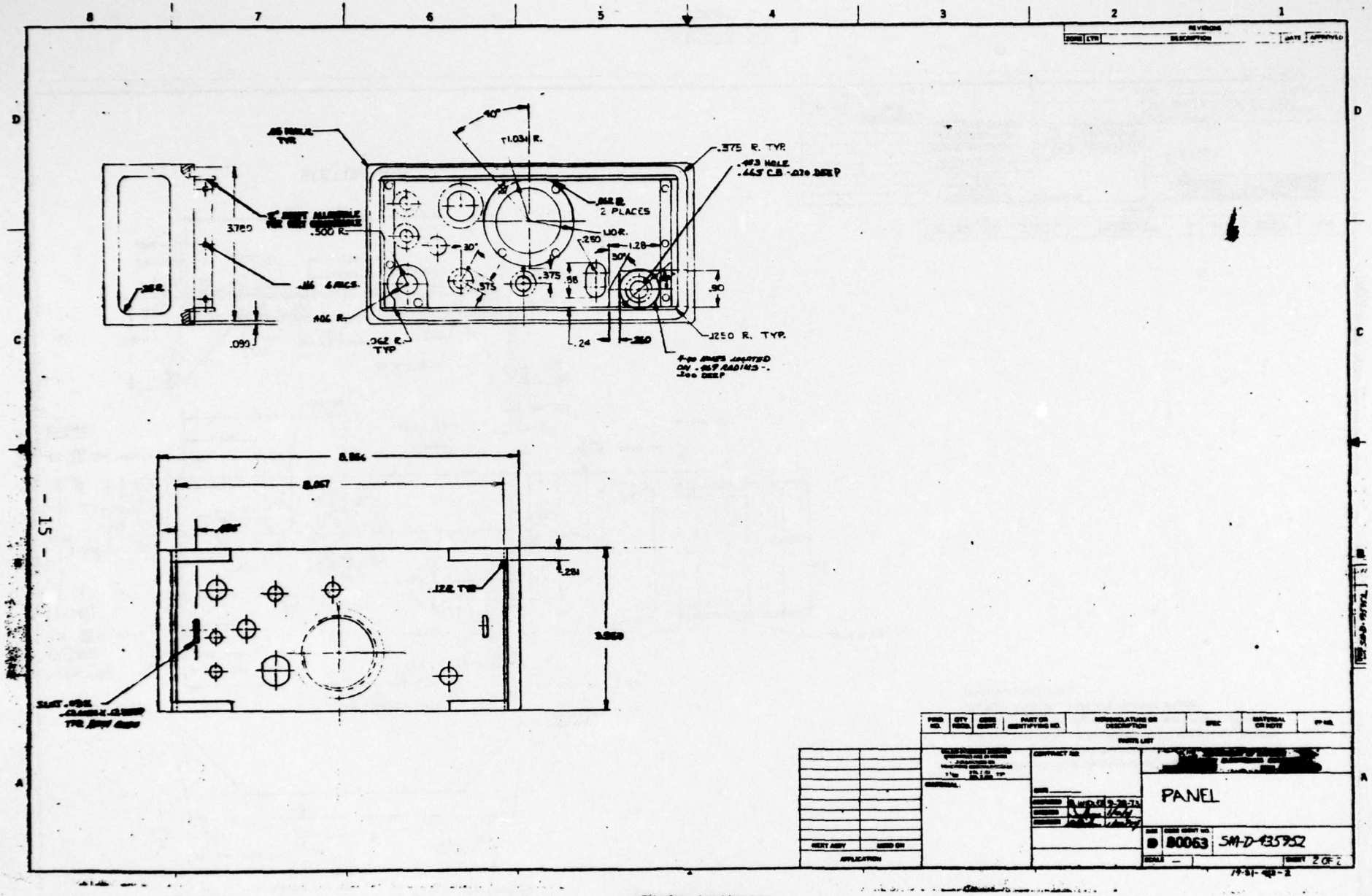

FIGURE NO. 3
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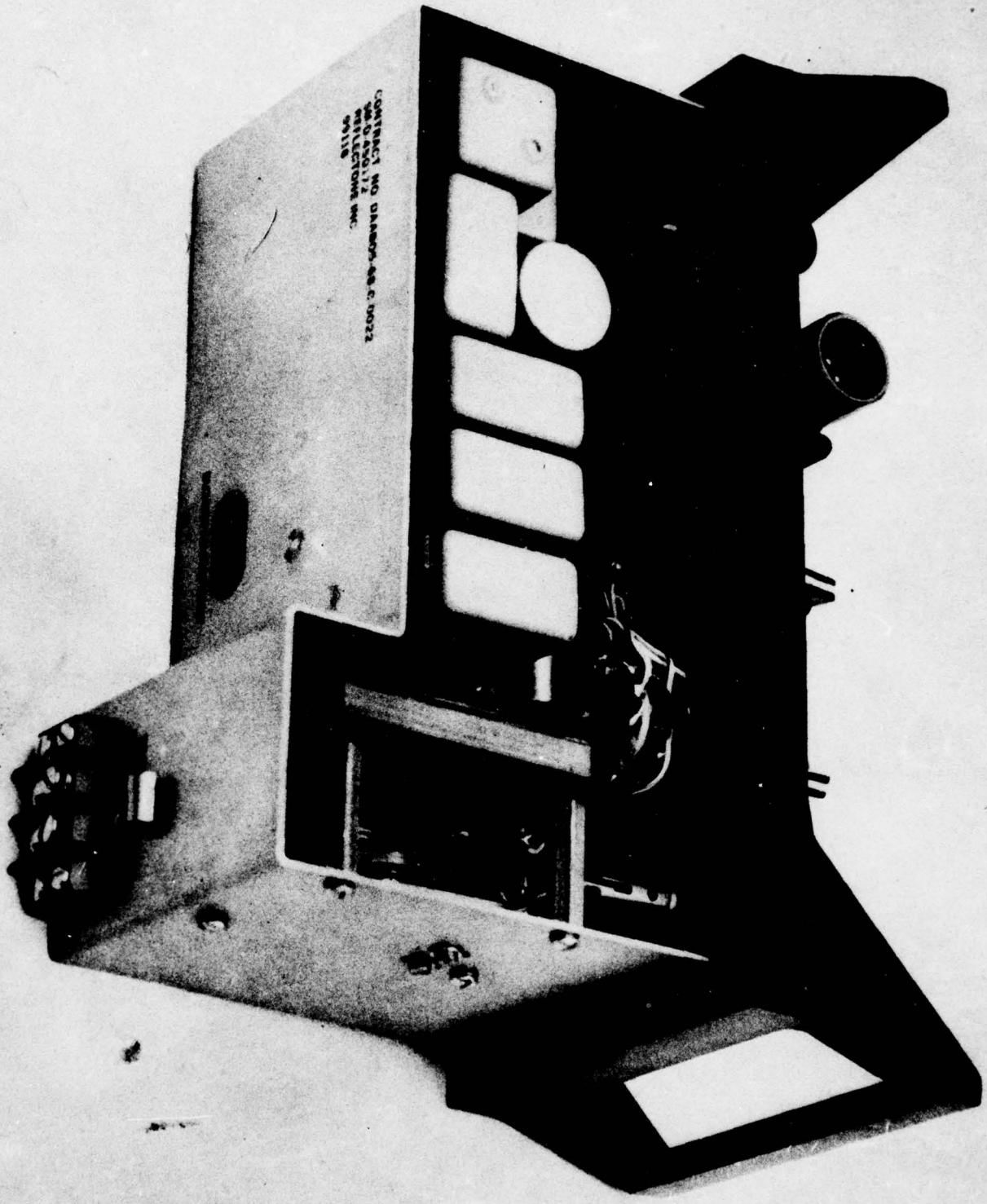

PHOTO NO. 3
TOP PANEL (REMOTE)
RADIO CHASSIS INSTALLED

3. Top Panel (Remote) (Continued)

The most obvious redesign factor of the top panels (see Photo No. 2, Item A) was that the carrying handles were molded into the panel instead of being attached by screws as was done in the original design (metal housings). This feature is probably the most significant design improvement made in the redesign. The redesigned panels offer improved ruggedness, less manufacturing or assembly operations and therefore, lower cost than the existing metal housing. Additionally, the weight savings on this panel alone was cut in half.

Some problems were experienced in the high heat/high humidity drop test of SCS-458, again in regard to the loosening of hardware. This problem, as on the bottom cover, will be discussed in detail in sub-paragraph "F" of this section.

The material used for this panel was the same grade of polycarbonate as mentioned earlier in this section for the cover and case.

4. Top Panel (Local) (Figure 4)

The top panel of the local unit is very similar to the remote unit and therefore, the same manufacturing, assembly and test problems existed. Further discussion of this part would offer only a repeat of the above. See Item "A" of Photo No. 2.

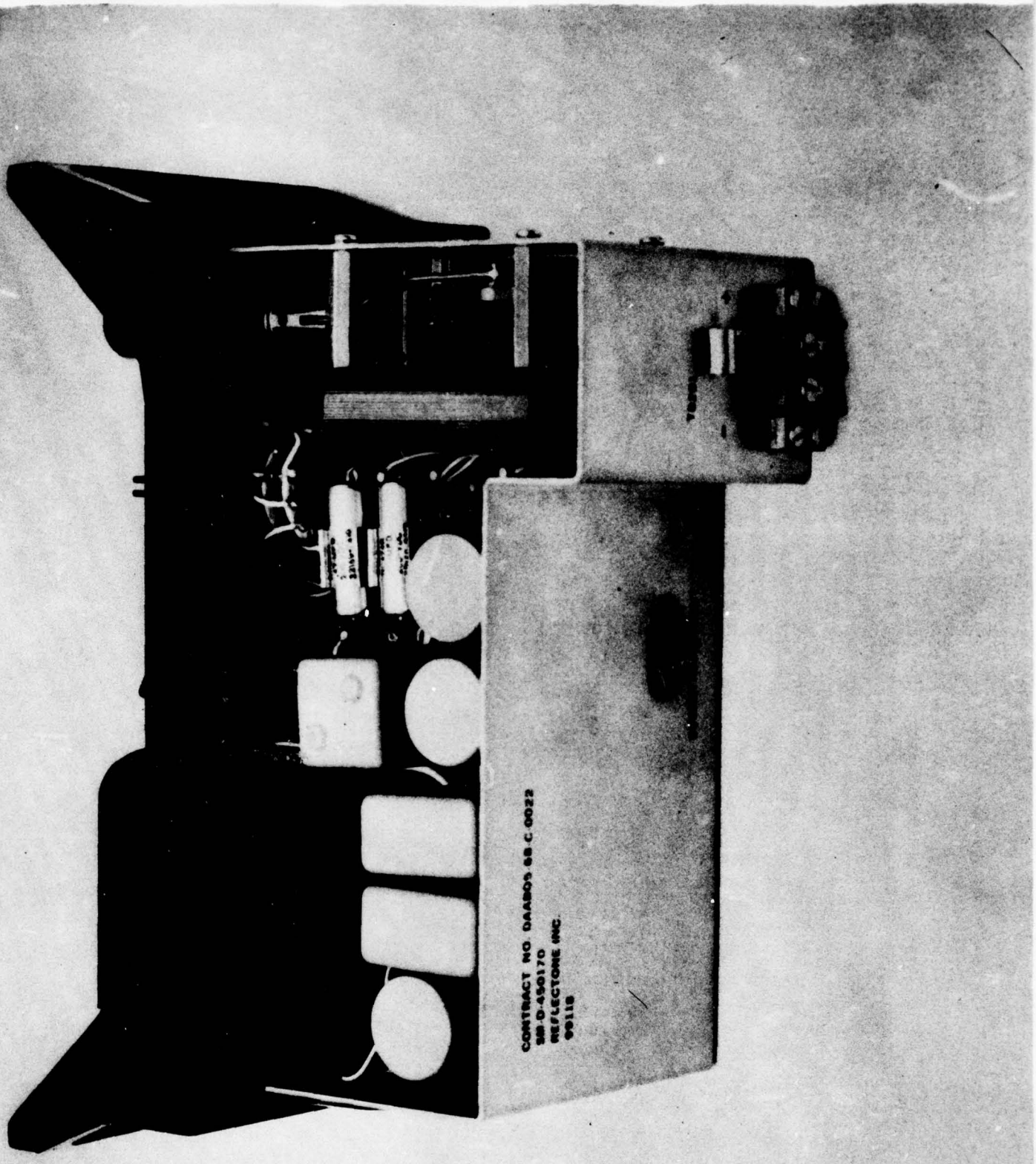

PHOTO NO. 4
TOP PANEL (LOCAL)
RADIO CHASSIS INSTALLED

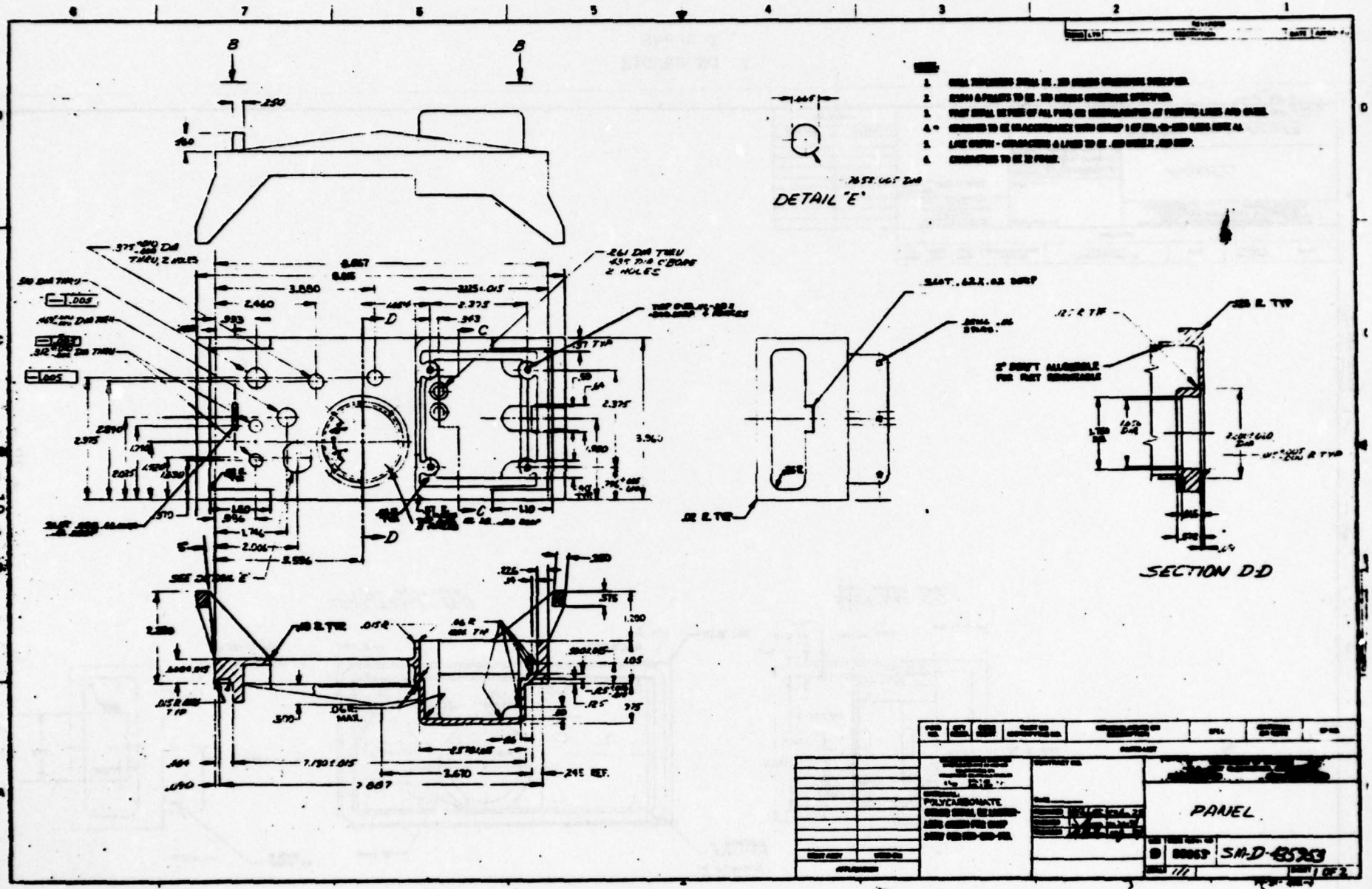

FIGURE NO. 4
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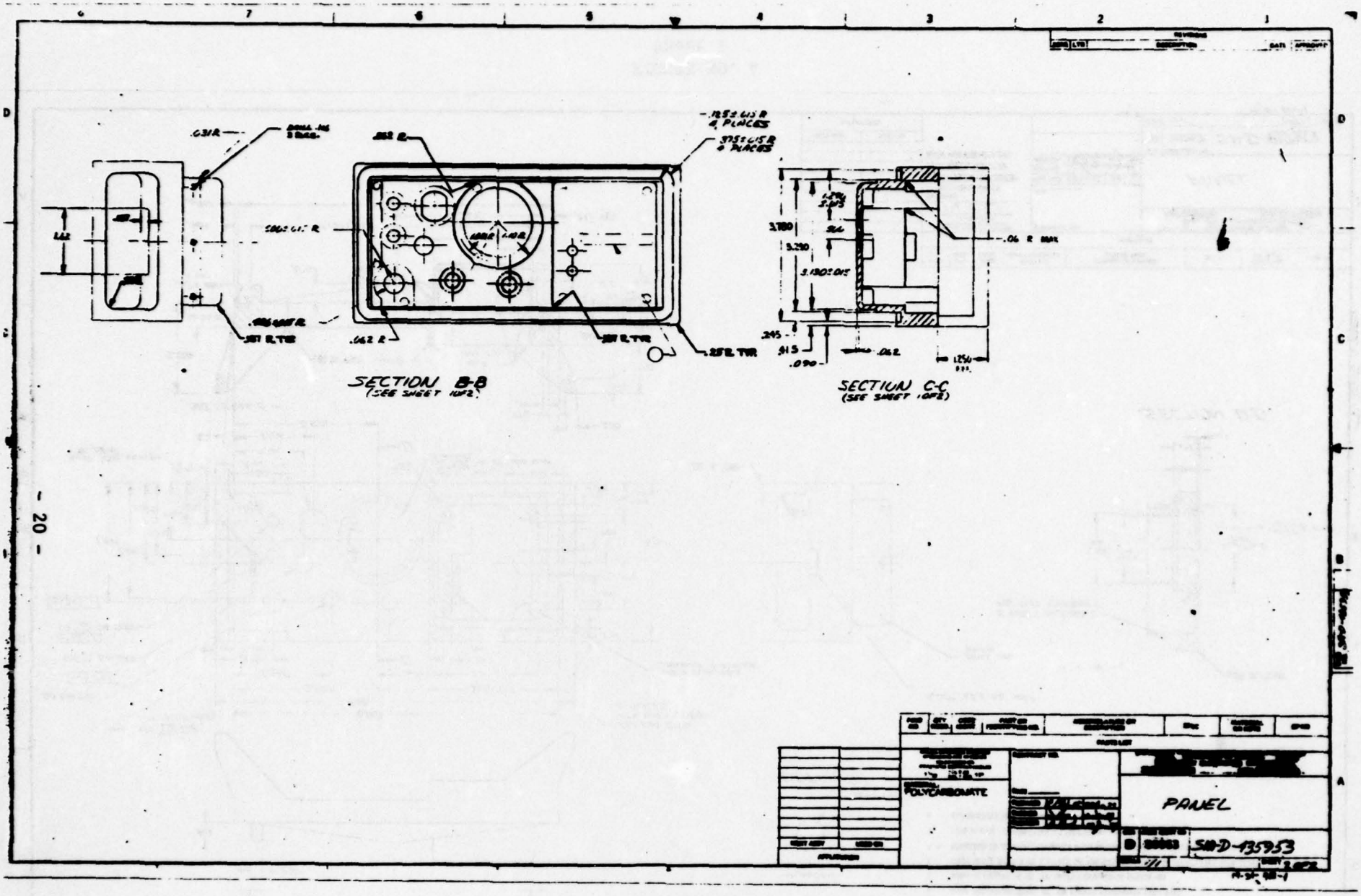

FIGURE NO. 4
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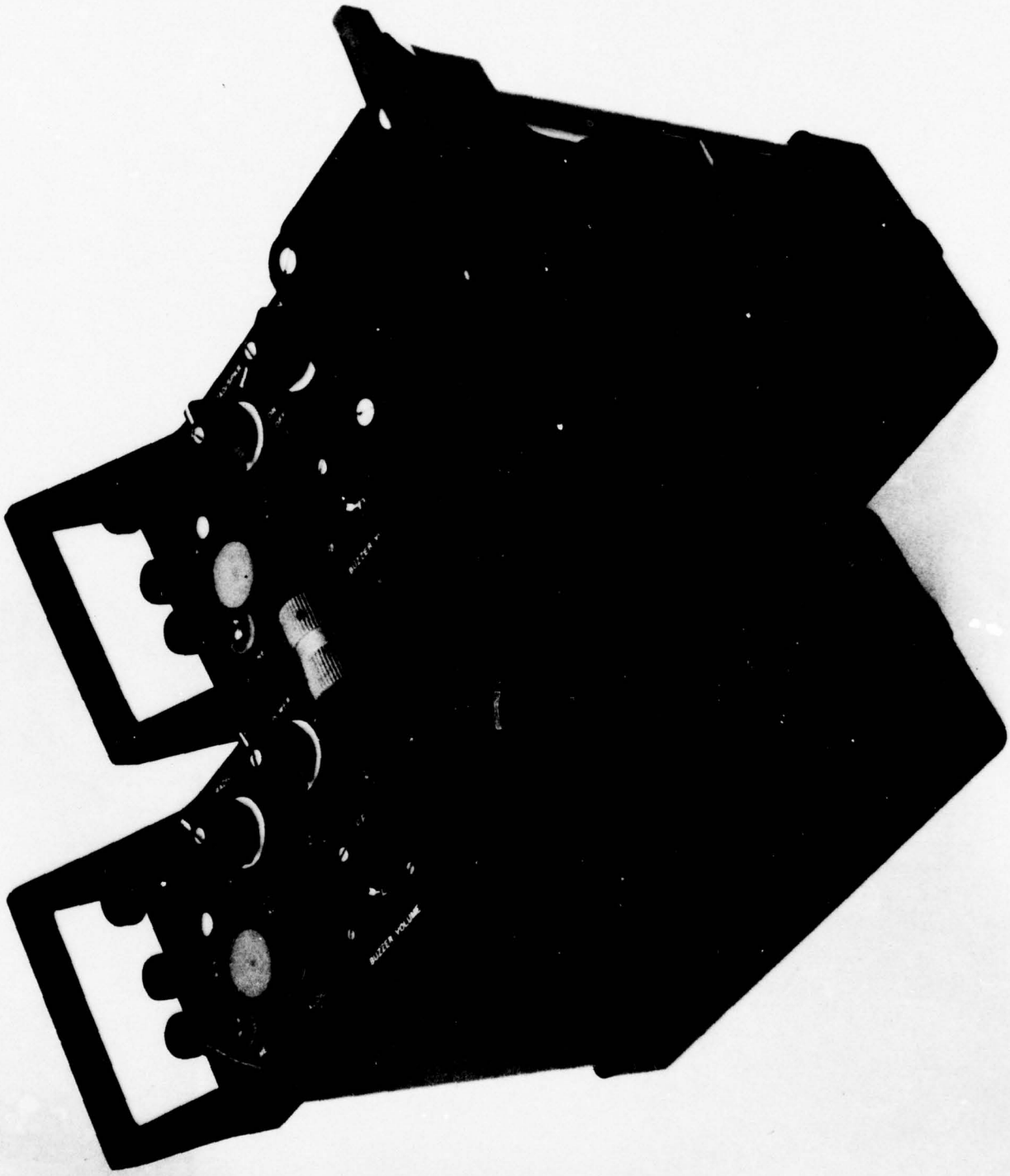


PHOTO NO. 5
GRA-39 RADIO SET
INSTALLED IN PLASTIC HOUSING

D. Quality Assurance

1. Introduction

Quality Assurance Measures were performed as parts were received by Eagle-Picher's Quality Control Plan. In addition to this initial inspection plan, the battery cases and their parts were qualified by First Article Testing and by visual sampling.

First Article Tests were conducted on the cases and components per Paragraph 4.4 of SCS-458.

The following are the test paragraphs from the Acceptance Test Report indicating applicable testing for each article.

a. External and internal dimensions of case, covers and insertable assemblies, when such dimensions affect insertion of items.

b. Dimensions of cavities, when such dimensions affect insertion of items.

c. Location of matches or fasteners on separate parts of assemblies which must mate, such as cases, covers and mountings.

d. Location of components, fasteners and mountings.

2. Standard Test Conditions

Unless otherwise specified herein, all measurement and tests shall be made at a temperature between 68°F and 95°F, ambient atmospheric pressure and relative humidity.

3. Test Equipment and Inspection Facilities

Test equipment and inspection facilities shall be of sufficient accuracy, quality and quantity to permit performance of the required inspection. The contractor shall establish calibration of test equipment to the satisfaction of the Government inspector.

4. Applicable Documents

a. SCS-458

b. MIL-R-55154B

c. MIL-STD-810B

6.1 Temperature Cycling

6.1.1 Test Equipment

a) Temperature Chamber (2), Messimer sufficient size and range to accommodate the test.

6.1.2 Test Procedure

The temperature cycling was conducted in accordance with Method 503, Procedure 1 of MIL-STD-810.

6.1.3 Test Results

At the conclusion of the test, the test samples were examined. No apparent damage was noted.

6.2 Mechanical Shock

6.2.1 Test Equipment

a) Quick Release Drop Hook (Electronically Activated)

b) Cradling Net

c) Attaching Hook

6.2.2 Test Procedure

The test samples were tested in accordance with Method 516.1, Procedure II of MIL-STD-810. The test samples were dropped from a height of 48 inches for a total of 26 drops.

6.2.3 Test Results

No apparent damage resulted from the drop test. Only minor scuffing and scraping of the housings was evident.

6.3 Bounce Test

6.3.1 Test Equipment

a) Package Tester, Type 1000-SC as made by L.A.B. Corporation, Skaneateles, New York.

6.3.2 Test Procedure

The test samples were subjected to the test of Method 514, Procedure XI of MIL-STD-810.

6.3.3 Test Results

No operation damage occurred to the radio housings during the bounce test.

6.4 Vibration

6.4.1 Test Equipment

a) Shaker, Ling, 275A

b) Power Supply, Ling, PP-60/80

6.4.2 Test Procedure

The test samples were subjected to the tests of Method 514, Procedure IX, Part 1, of MIL-STD-810.

6.4.3 Test Results

No operational or physical damage occurred from the vibration testing.

6.5 Immersion

6.5.1 Test Equipment

a) Immersion Tank to accommodate 36 inches of water over the upper most part of the radio housing.

6.5.2 Test Procedure

The test samples were tested in accordance with Method 512, Procedure I of MIL-STD-810.

6.5.3 Test Results

No leakage was present at conclusion of the test.

6.6 Air Seal

6.6.1 Test Equipment

a) Vacuum Pump

b) Shut-Off Valve

c) Mercury Manometer, Meriam, Model 31EC10

6.6.2 Test Procedure

The test was conducted in accordance with Paragraph 4.9 of MIL-R-55154B.

6.6.3 Test Results

The radios passed the requirements of 4.9 of MIL-R-55154B.

6.7 Humidity

6.7.1 Test Equipment

a) Humidity Chamber, ATO - Model HB4127.

6.7.2 Test Procedure

The test samples were subjected to the testing required by Method 507, Procedure II of MIL-STD-810B.

6.7.3 Test Results

The radio cases passed the Humidity Test. Hardware remained secure with no loosening.

6.8 High Temperature - High Humidity Drop

6.8.1 Test Equipment

a) Humidity Chamber, ATL - Model HB4127

b) Quick Release Hook

c) Cradling Net

6.8.2 Test Procedure

The samples were tested in accordance with Paragraph 4.4.8 of Specification SCS-458.

6.8.3 Test Results

No failures were experienced during the drop testing of Para. 4.4.8 of SCS-458.

6.9 Low Temperature Drop

6.9.1 Test Equipment

a) Temperature Chamber

b) Quick-Release Hook

c) Cradling Net

6.9.2 Test Procedure

The test samples were subjected to the testing of Paragraph 4.4.9 of SCS-458.

6.9.3 Test Results

The test samples did not sustain any damage which would impair the function of the housings during the drop test.

6.10 Altitude

6.10.1 Test Equipment

a) Altitude Chamber

6.10.2 Test Procedure

The test was performed in accordance with Method 500, Procedure I of MIL-STD-810B.

6.10.3 Test Results

The radio housings sustained no damage as a result of the altitude test.

6.11 Fungus Test

Fungus testing was not performed due to contract modification.

6.12 Salt Fog

6.12.1 Test Equipment

a) Salt Fog Chamber - Industrial Filter and Mfg. Co., Model 411.1 ABC.

6.12.2 Test Procedure

The test samples were tested in accordance with Method 509, Procedure I of MIL-STD-810B.

6.12.3 Test Results

The housings sustained no damage or deterioration due to the salt fog test.

6.13 Rain

6.13.1 Test Equipment

a) Humidity Chamber (Modified), ATL, Model HB4127.

6.13.2 Test Procedure

The testing was performed in accordance with Method 506, Procedure I of MIL-STD-810.

6.13.3 Test Results

The housings showed no signs of leakage after the rain test.

6.14 Sand and Dust

6.14.1 Test Equipment

a) Sand and Dust Chamber, Standard Model 1195.

6.14.2 Test Procedure

The test was performed in accordance with Method 510, Procedure I of MIL-STD-810.

6.14.3 Test Results

The housings passed the sand and dust test. No sand or dust penetrated the housings. All controls remained operable.

6.15 Low Temperature - Non-Operating

6.15.1 Test Equipment

a) Temperature Chamber - Conrad

6.15.2 Test Procedure

The test samples were tested in accordance with MIL-STD-810, Method 502, Procedure I.

6.15.3 Test Results

No apparent damage resulted from the test.

6.16 High Temperature - Non-Operating

6.16.1 Test Equipment

a) Temperature Chamber - Messimer

6.16.2 Test Procedure

The test samples were subjected to the testing of MIL-STD-810, Procedure II, Method 501.

6.16.3 Test Results

No damage to the housings resulted from the high temperature - non-operating test.

6.17 Sunshine

6.17.1 Test Equipment

a) Incondesant Spot Lamp - G. E.

6.17.2 Test Procedure

The samples were subjected to simulated sunshine in accordance with MIL-STD-810, Method 505, Procedure I.

6.17.3 Test Results

No fading, cracking or other deterioration was apparent as a result of the test.

6.18 Flammability

6.18.1 Test Equipment

a) Propane Torch

6.18.2 Test Procedure

The test was performed on a representative housing in accordance with Paragraph 4.4.18 of SCS-458.

6.18.3 Test Results

The housing after being subjected to an open flame for a minimum of 15.0 seconds, extinguished immediately upon the removal of the flame.

6.19 Electromagnetic Testing

Deleted from specification for this program.

6.20 Weight

6.20.1 Test Equipment

a) Scales - Toledo, Model 3710, Accuracy ± 1.0 gram.

6.20.2 Test Procedure

The test samples were inspected per Para. 3.1.2 of SCS-458.

6.20.3 Test Results

S/N 11979

Remote 6.47 Lbs.

Local 5.51 Lbs.

S/N 11980

Remote 6.48 Lbs.

Local 5.55 Lbs.

S/N 8417

Remote 6.45 Lbs.

Local 5.54 Lbs.

E. Production Run

Records were made during the PEM Program to analyze costs of piece part items and equipment. Yield rates were also maintained for each of the four (4) parts manufactured. Table I summarizes materials selection, material physical properties and manufacturing methods.

Table II summarizes cost comparisons between the new plastic housings and the original metal housings.

TABLE I

MATERIAL SELECTION AND PROPERTIES

PART	E-P DWG.	USAECOM NO.	SELECTED MATERIAL	MFG. METHOD.	REASON FOR SELECTION	SOURCE OF MATERIAL	WEIGHT ORIG.	WEIGHT NEW
Case	19-31-412-0	SM-D-435951	Lexan 101-SE	Injection Mold	Lightweight Ruggedness Producibility High Prod. Rates Low Cost	General Electric	2.90	1.05
Cover, Bottom	19-31-412-3	SM-D-435949	Lexan 101-SE	Injection Mold	Same as Above	General Electric	1.38	.50
Panel (Local)	19-31-412-1	SM-D-435953	Lexan 101-SE	Injection Mold	Same as Above	General Electric	1.82	.66
Panel (Remote)	19-31-412-2	SM-D-435952	Lexan 101-SE	Injection Mold	Same as Above	General Electric	1.57	.57

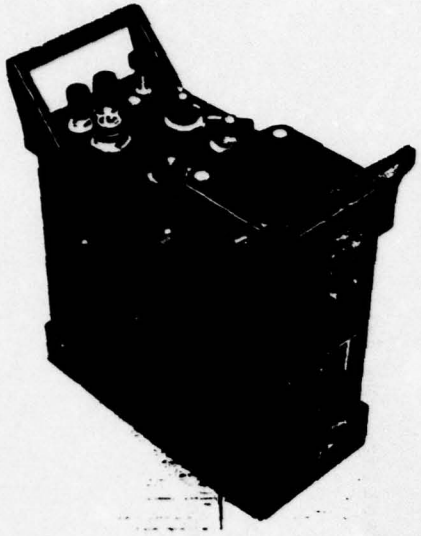
TABLE II
COST ANALYSIS AND PRODUCTION RATES
BEFORE AND AFTER PEM

PART DESCRIPTION	PART NO.	BEFORE COST OF EQUIP.	AFTER COST OF EQUIP.	BEFORE COST PER PART	AFTER COST PER PART	PROD. RATE BEFORE	PROD. RATE AFTER	MFG. METHOD BEFORE	MFG. METHOD AFTER	SUPPLIER
Case	SM-D-435951	$5,000*	$12,000	$20 *	$5.00	6 Per Hr.*	50 Per Hr.	Die Cast	Injection Mold	Western Controls, Wichita, Ks.
Cover	SM-D-435949	$2,000*	$5,000	$10*	$3.00	6 Per Hr.*	50 Per Hr.	Die Cast	Injection Mold	Same as above.
Panel, Remote	SM-D-435952	$2,500*	$12,000	$20*	$4.00	6 Per Hr.*	50 Per Hr.	Die Cast	Injection Mold	Same as above.
Panel, Local	SM-D-435953	$2,500*	$12,000	$20*	$4.00	6 Per Hr.*	50 Per Hr.	Die Cast	Injection Mold	Same as above.

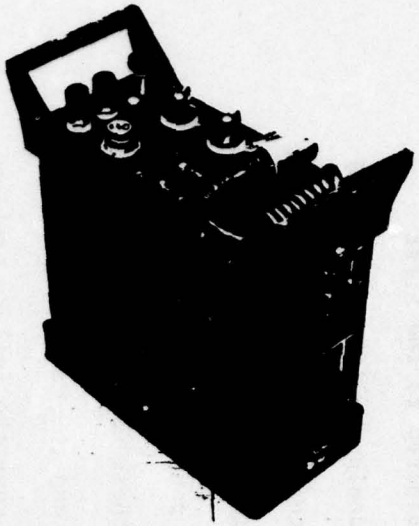
* Estimate by Eagle-Picher

PHOTO NO. 6

PLASTIC AND METAL HOUSINGS

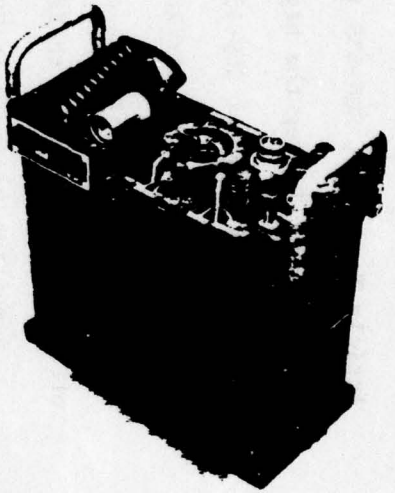


REMOTE UNIT - PLASTIC HOUSINGS



LOCAL UNIT - PLASTIC HOUSINGS

REMOTE UNIT - METAL HOUSINGS



LOCAL UNIT - METAL HOUSINGS

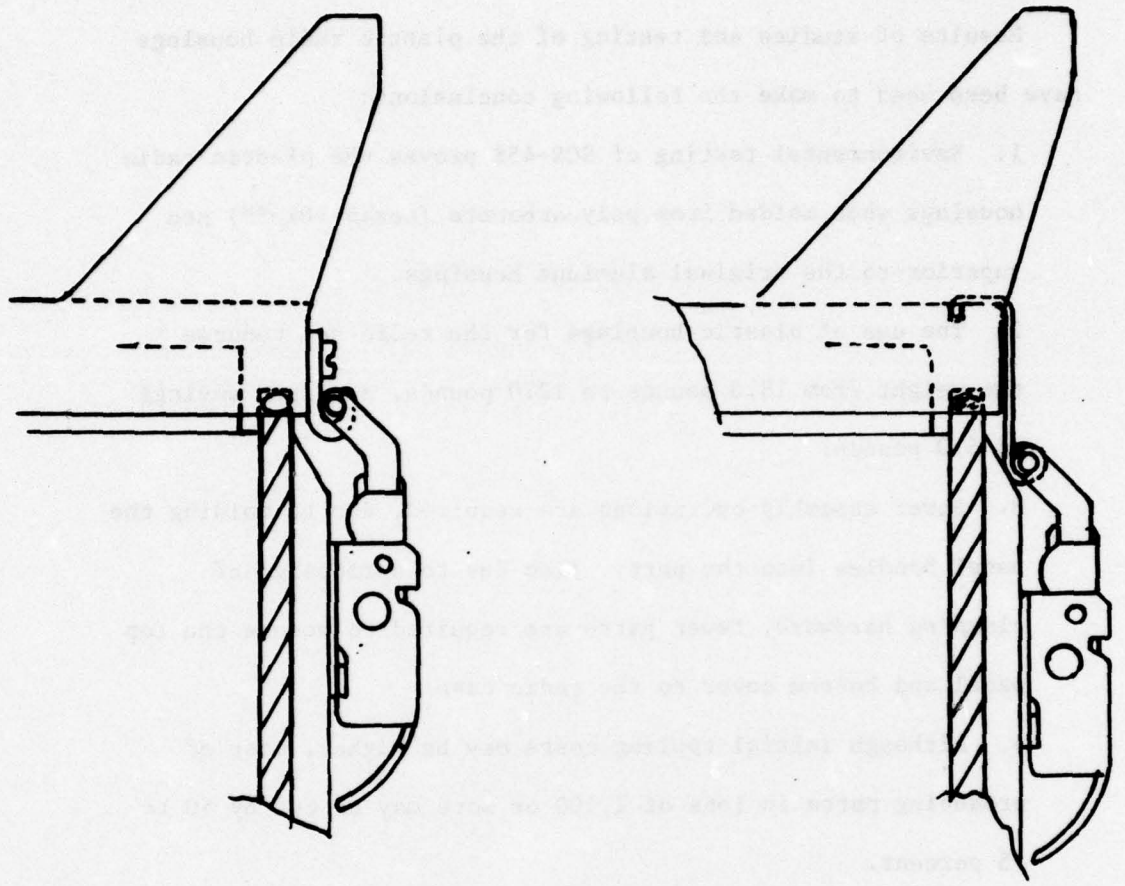
F. Design Modifications

The plastic housings after being subjected to the First Article Testing of SCS-458 indicated a design modification would be required. During the high temperature/high humidity drop test of Paragraph 4.4.8 of SCS-458, the housing failed. The attaching screws which held the strike on the top panels and the bottom cover were loosened to the extent that their was no longer an effective seal between those components and the case assembly.

A meeting was held at USAECOM to discuss the failure problem. It was agreed during the meeting to delete the strikes from the panel and cover and instead incorporate an indentation in each component to accommodate a clamping device which would be part of the latch assembly. (See Figure 5 for details of this modification.)

The modification was made and one (1) radio set was retested per Paragraph 4.4.8 of SCS-458 with no further failures experienced. The new design endured the test with no visible degradation. This design was therefore incorporated on the pilot production run and the units were subjected to Acceptance Testing. No failures were encountered with the new design.

The new design not only proved much more reliable, but also was less expensive because it reduces machining and assembly operations.



OLD METHOD

NEW METHOD

FIGURE NO. 5

G. Conclusions

Results of studies and testing of the plastic radio housings have been used to make the following conclusions:

1. Environmental testing of SCS-458 proves the plastic radio housings when molded from polycarbonate (Lexan 101-SE) are superior to the original aluminum housings.

2. The use of plastic housings for the radio set reduces the weight from 18.0 pounds to 12.0 pounds, a weight savings of 6.0 pounds.

3. Fewer assembly operations are required, due to molding the panel handles into the part. Also due to a redesign of clamping hardware, fewer parts are required to secure the top panel and bottom cover to the radio case.

4. Although initial tooling costs may be higher, cost of producing parts in lots of 2,500 or more may be cut by 50 to 75 percent.

5. Production rates can be improved significantly using the injection mold method of manufacture.

6. Part finish work is reduced to minimum, since the raw stock material is bought to the required color, eliminating the paint operation.

Discussion:

In view of the above presented data, it appears that there should be no question in regard to the superiority of the plastic housings over the existing aluminum housings.

II. PROCESS SPECIFICATIONS

A. Case (SM-D-435951)

1. Manpower and Space Required

OPERATION	DESCRIPTION	MAN MINUTES REQUIRED PER LOT	PER PART
Set-Up Time	Time Required to Get Equipment Ready for Molding	480	
Molding Time	Actual Time Needed to Mold the Part		1.3
Drilling Operations	Drill Holes for Hardware		5
Assembly	Install Latches and Labels		10
	TOTAL	480	16.3

MOLDER: Western Controls
2533 Southwest Street
P. O. Box 1202
Wichita, Kansas 67201

Floor Space Available: Approximately 50,000 sq. ft.

Floor Space Needed: 5,000 sq. ft.

2. Equipment, Tools, Jigs and Fixtures Required

(a) Mold - 19-31-412-0

(b) Molding Machine - Reed, Model 300, Reciprocating Screw, 30 oz., 350 ton maximum for preparing resin for injection into mold.

(c) Oven - Size and temperature range to meet production requirements. Used to dry the resin previous to molding.

(d) Scales - For weighing moisture content of material. Type and capacity to meet application.

(e) Drill Press - Type and size dependent on production rate. (Used to drill holes as required.)

(f) Drill Jigs - For positioning holes for mounting hardware.

3. Material Required (ABS)

(a) Polycarbonate (Unfilled)

(b) Lexan, 101-SE (GSM)

(c) Form - Pelletized Custom Color 3015 Dk. Green

The advantages of this material are that it is one of the easier plastics to mold and possesses excellent impact strength. The material will withstand severe impacts which may occur in shipment or in field use.

4. Molding Operations

(a) Drying - Place stock material in oven or in hopper dryer. Adjust temperature to 170 - 190°F. Dry stock material until there is less than .05 of 1% moisture by weight.

(b) Fill hopper (if stock material was dried in an oven) with resin.

(c) Preheat mold to 150°F.

(d) Stabilize stock material from 435 to 475°F depending on existing conditions (plastication). This is done by the heater band elements located within the mold cylinder. Slight readjustment may be necessary as cycling of mold progresses.

(e) Regulate nozzle temperatures not to exceed temperatures of the stock material.

4. Molding Operations (Continued)

(f) Meter stock into cylinder and regulate temperature of stock as follows.

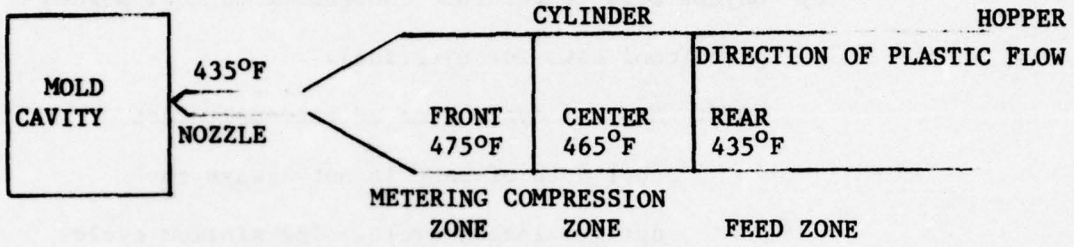


FIGURE NO. 6

(g) Fill mold cavity and make following adjustments during cycling.

1) Injection Pressure 10,000 - 20,000 psi.

2) Shot Weight should be 476 grams.

3) Regulate fill speed at 5 3/4 inches.

4) Adjust screw speed to 9.9 (yellow).

NOTE: The above is a general setting. Ultimate choice of fill speed should be one that completely fills and will consistently mold satisfactory parts. Faster fill speeds can cause short shots, burning of the plastic material or weld lines.

4. Molding Operations (Continued)

5) During cycling of machine and once normal screw rpm and heater band adjustments have reached optimum operating efficiency; adjust "back pressure" to approximately 100 psi to maintain a close control over stock temperature.

6) Adjust mold temperature controller to cool molded part (cool down for ejection).

NOTE: Minimum cycle time or extremely fast cool down of part is not always the optimum length cycle. The minimum cycle is often too sensitive to changes in ambient temperature. Increasing cycle times of only one or two seconds can increase reject rates considerably.

7) Check part ejection system as cycling commences to insure against "pile ups".

(h) Consult Figure No. 7 for complete molding specifications.

NOTE: The above is general information based on experience; however, "values can change with varying conditions, materials, part design, etc." The molder must make any adjustments or alterations as the molded sampling indicates necessary. Table III is provided to aid in troubleshooting molding problems.

7/10/74

PLASTIC DEPT. INTERSHOP ORDER

INTERSHOP ORDER NO.	PART NUMBER 19-31-412-0	MATERIAL CODE NUMBER
QUANTITY TO PRODUCE	PRINT REVISION	
DATE ISSUED	DATE DUE	MATERIAL DESCRIPTION Lexan 101,3015 Dk.Green
MATERIAL FOR THIS ORDER	COLOR	
MATERIAL STATUS	CUSTOMER P.O. NUMBER	NET WEIGHT PER PART 476.0 GR. / SHOT WEIGHT OZ. / QUOTED MACHINE 300 Reed (30oz. cylinder)
	HOURS REQD. TO PRODUCE ORDER	NO. CAVITIES IN MOLD 1 / MOLD NUMBER / QUOTED CYCLE 80 SEC. / QUOTED SET-UP TIME 1.13390

CUSTOMER: Eagle Picher (Joplin) Case
PART NO.: 19-31-412-0
FINAL ASSEMBLY NUMBER
INTERSHOP ORDER NO.

HEAT ZONES	MOLDING MACHINE 200 18oz.			TIMER SETTINGS	MOLDING MACHINE 200 18oz.			HYDR. PRESSURE	MOLDING MACHINE 200 18oz.		
NOZZLE CODE NO.				PLUNGER FORWARD	18.0			FIRST STAGE	1850#		
NOZZLE	435°			DIES CLOSED	28.0			SECOND STAGE	600#		
FRONT	475°			DELAY UNLOAD	7.8			SCREW SPEED RANGE	LOW		
CENTER	465°			DIES OPEN	5.0			SCREW BACK P.S.I.			
REAR	435°			DECOMPRESS				FEED SETTING	5 3/4"		
MANIFOLD				STUFFING				SCREW RETRACTION	28.0		
MOLD TEMP. STATIONARY	150°			PLUNGER ADVANCE				RAM IN MOTION	8.0		
MOLD TEMP. MOVING	150°			CYCLE SECONDS	60.0			SCREW SPEED SETTING	Yellow 9.9		
MOLD TEMP. SLIDES	150°			RATE PARTS/HR				INSPECTION SPEED SETTING	Blue 5.0		
CYL. WATER TEMP.	75°				.01666			MELT TEMP.			

OPER. NO.	TOOLS REQUIRED	TOOL LOC.	DESCRIPTION OF OPERATIONS	INSP.	SET-UP TIME HRS.	SET-UP TIME DATE & INITIAL
1	Mold		Injection mold (1) part per cycle and hand clip sprue.			
2	Fixture		Trim sprue flush with drill press.			
			Box for shipment.			
			Spray cores front and back every 2 shots.			
					TEAR-DOWN TIME HRS.	TEAR-DOWN TIME DATE & INITIAL

PACKAGING INSTRUCTIONS

FIGURE NO. 7

GROSS _____ BOX NO. _____

TARE _____ QTY. PER BOX _____

NET _____

START	DATE & INITIAL	STOP	DATE & INITIAL	TOTAL HOURS

FINISH DATE

EXACT QTY. PRODUCED

5. Machining Operations

(a) Using drill jib 19-31-412-0, locate and drill eight hardware mounting holes per Drawing 19-31-412-0.

(b) Top to holes inside case cavity per Drawing 19-31-412-0.

6. Assembly of Hardware

(a) Install four (4) latches with eight (8) screws per Drawing in the Appendix of this report.

(b) Install battery positioning, and identification label as required.

7. Mold Maintenance

(a) Use dry air to blow out cooling channels.

(b) Core and cavity areas are sprayed with commerical rust preventative.

(c) Close mold and place in an assigned position in mold storage rack. Mold storages are located in an air conditioned area.

B. Cover, Bottom (SM-D-435949)

1. Manpower and Space Required

OPERATION	DESCRIPTION	MAN MINUTES REQUIRED PER LOT	PER PART
Set-Up Time	Time Required to Get Equipment Ready for Molding	480	
Molding Time	Actual Time Needed to Mold the Part		1.16
Drilling Operations	Drill Holes for Hardware		None
Machining Operation			None
Assembly	Gasket (Assemble Lower Case)	____	3
	TOTAL	480	4.16

1. Manpower and Space Required (Continued)

MOLDER: Western Controls
2533 Southwest Street
P. O. Box 1202
Wichita, Kansas 67201

Floor Space Available: Approximately 50,000 sq. ft.

Floor Space Needed: 5,000 sq. ft.

2. Equipment, Tools, Jigs and Fixtures Required

(a) Mold - 19-31-412-3

(b) Molding Machine - Reed, Model 200, Reciprocating Screw, 18 oz., 350 ton maximum for preparing resin for injection into mold.

(c) Oven - Size and temperature range to meet production requirements. Use to dry the resin previous to molding.

(d) Scales - For weighing moisture content of material. Type and capacity to meet application.

3. Material Required

(a) Polycarbonate (unfilled).

(b) Lexan 101-SE

(c) Form - Pelletized Custom Color 3015, Dk. Green

4. Molding Operations

(a) Drying - Place stock material in oven or in hopper dryer. Adjust temperature to 170-190°F. Dry stock material until there is less than .05 of 1% moisture by weight.

(b) Fill hopper (if stock material was dried in an oven) with resin.

4. Molding Operations (Continued)

(c) Mold Temperature (chiller)

(d) Stabilize stock material from 450 to 475°F depending on existing conditions (plastication). This is done by the heater band elements located within the mold cylinder. Slight readjustment may be necessary as cycling of mold progresses.

(e) Regulate nozzle temperature not to exceed temperatures of the stock material.

(f) Meter stock into cylinder and regulate temperature of stock as follows.

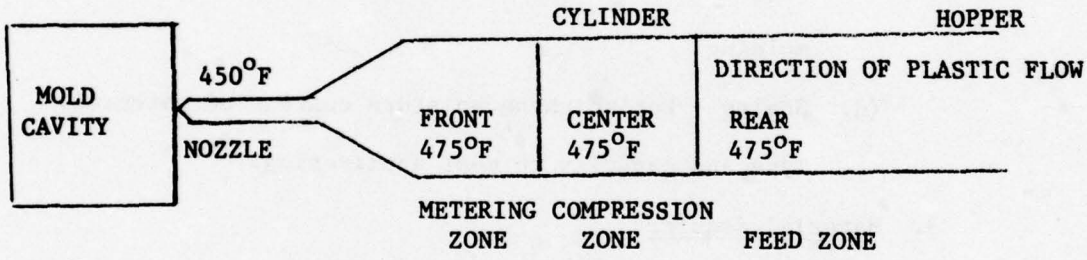


FIGURE NO. 8

(g) Fill mold cavity and make following adjustments during cycling.

1) Injection Pressure 10,000 - 20,000 psi

2) Shot Weight should be 225 grams.

3) Regulate fill speed at 2 7/8 inches.

4. Molding Operations (Continued)

4) Adjust screw speed to medium range (2.0 yellow).

NOTE: The aobve is a general setting. Ultimate choice of fill speed should be one that completely fills and will consistently mold satisfactory parts. Faster fill speeds can cause short shots, burning of the plastic material or weld lines.

5) During cycling of machine and once normal screw rpm and heater band adjustments have reached optimum operating efficiency; adjust "back pressure" to approximately 100 psi to maintain a close control over stock temperature.

6) Adjust mold temperature controller to cool molded part (cool down for ejection).

NOTE: Minimum cycle time or extremely fast cool down of part is not always the optimum length cycle. The minimum cycle is often too sensitive to changes in ambient temperature. Increasing cycle times of only one or two seconds can increase reject rates considerably.

7) Check part ejection system as cycling commences to insure against "pile ups".

4. Molding Operations (Continued)

(h) Consult Figure No. 9 for complete molding specifications.

NOTE: The above is general information based on experience; however, "values can change with varying conditions, materials, part design, etc." The molder must make any adjustments or alterations as the molded sampling indicates necessary. Table III is provided to aid in troubleshooting molding problems.

5. Assembly Operations - Install Cover Gasket

(a) SM-A-435969 to the cover using RTV-108 as supplied by the General Electric Company.

(b) Install identification label as required.

6. Mold Maintenance

(a) Use dry air to blow out cooling channels.

(b) Core and cavity areas are sprayed with commercial rust preventative.

(c) Close mold and place in an assigned position in mold storage rack. Mold storages are located in an air conditioned area.

INTERSHOP ORDER NO. | PART NUMBER 19-31-412-3

PLASTIC DEPT. INTERSHOP ORDER 7/8/74

QUANTITY TO PRODUCE | PRINT REVISION

DATE ISSUED | DATE DUE

MATERIAL FOR THIS ORDER | COLOR

MATERIAL STATUS | CUSTOMER P.O. NUMBER

HOURS REQD. TO PRODUCE ORDER

MATERIAL CODE NUMBER 060-1205-60

MATERIAL DESCRIPTION: Lexan 101, 3015 Dk. Green

Customer: Eagle Picher (Joplin) | Part No.: 19-31-412-3 | Final Assembly Number: Cover | Intershop Order No.:

NET WEIGHT PER PART	SHOT WEIGHT	QUOTED MACHINE	
225.0 GR.	OZ.	200 Reed	.54[illegible]

NO. CAVITIES IN MOLD	MOLD NUMBER	QUOTED CYCLE	QUOTED SET-UP TIME
1	316	70 SC.	

HEAT ZONES	MOLDING MACHINE 200 18oz.			TIMER SETTINGS	MOLDING MACHINE 200 18oz.			HYDR. PRESSURE	MOLDING MACHINE 200 18oz.		
NOZZLE CODE NO.				PLUNGER FORWARD	22.5			FIRST STAGE	1700#		
NOZZLE	450°			DIES CLOSED	30.0			SECOND STAGE	1500#		
FRONT	475°			DELAY UNLOAD	6.0			SCREW SPEED RANGE	Med.		
CENTER	475°			DIES OPEN	5.0safety			SCREW BACK P.S.I.			
REAR	475°			DECOMPRESS				FEED SETTING	2 7/8"		
MANIFOLD				STUFFING				SCREW RETRACTION	24.0		
MOLD TEMP. STATIONARY	chiller			PLUNGER ADVANCE				RAM IN MOTION	3.5		
MOLD TEMP. MOVING	chiller			CYCLE SECONDS				SCREW SPEED SETTING	Yellow 2.0		
MOLD TEMP. SLIDES				RATE PARTS/HR				INSPECTION SPEED SETTING	Blue 3.5		
CYL. WATER TEMP.	75				[illegible]			MELT TEMP.			

OPER. NO.	TOOLS REQUIRED	TOOL LOC.	DESCRIPTION OF OPERATIONS	INSP.	SET-UP TIME HRS.	SET-UP TIME DATE & INITIAL
1 2 3	Mold Fixture	316	Injection mold (1) part per cycle and hand clip sprue. Trim Sprue flush with drill press. Box for shipment.			

TEAR-DOWN TIME: HRS. | DATE & INITIAL

PACKAGING INSTRUCTIONS

GROSS _____ BOX NO. _____

TARE _____ QTY. PER BOX _____

NET _____

START	DATE & INITIAL	STOP	DATE & INITIAL	TOTAL HOURS

FINISH DATE

EXACT QTY. PRODUCED

FIGURE NO. 9

C. Panel, Remote (SM-D-435952)

1. Manpower and Space Required

OPERATION	DESCRIPTION	MAN MINUTES REQUIRED PER LOT	PER PART
Set-Up Time	Time Required to Get Equipment Ready for Molding	480	
Molding Time	Actual Time Needed to Mold the Part		1.25
Drill & Tap Holes	For Hardware Installation		10
Assembly	Install Gasket, Brackets and Fill Lettering		15
	TOTAL	480	26.25

MOLDER: Western Controls
2533 Southwest Street
P. O. Box 1202
Wichita, Kansas 67201

Floor Space Available: Approximately 50,000 sq. ft.

Floor Space Needed: 5,000 sq. ft.

2. Equipment, Tools, Jigs and Fixtures Required

(a) Mold - 19-31-412-2

(b) Molding Machine - Reed, Model 300, Reciprocating Screw, 30 oz., 350 ton maximum for preparing resin for injection into mold.

(c) Oven - Size and temperature range to meet production requirements. Used to dry the resin previous to molding.

(d) Scales - For weighting moisture content of material. Type and capacity to meet application.

(e) Drill Press - Type and size dependent on production rate. (Used to drill and tap holes as required).

(f) Drill Jig - For positioning holes (19-31-412-2).

3. Material Required

(a) Polycarbonate (unfilled)

(b) Lexan 101-SE

(c) Form - Pelletized, Custom Color 3015, Dk. Green.

4. Molding Operations

(a) Drying - Place stock material in oven or in hopper dryer. Adjust temperature to 170-190°F. Dry stock material until there is less than .05 of 1% moisture by weight.

(b) Fill hopper (if stock material was dried in an oven) with resin.

(c) Preheat mold to 125°F.

(d) Stabilize stock material from 460 to 510°F depending on existing conditions (plastication). This is done by the heater band elements located within the mold cylinder. Slight readjustment may be necessary as cycling of mold progresses.

(e) Regulate nozzle temperatures at 510°F.

(f) Meter stock into cylinder and regulate temperature of stock as follows:

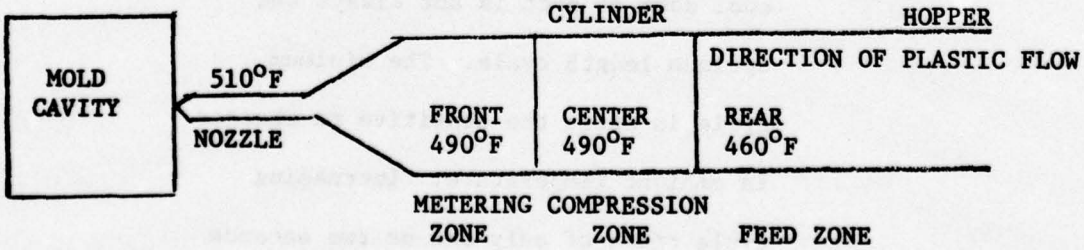


FIGURE NO. 10

4. Molding Operations (Continued)

(g) Fill mold cavity and make following adjustments during cycling.

1) Injection Pressure 10,000 - 20,000 psi

2) Shot Weight should be 260 grams

3) Regulate fill speed at 2 3/4 inches

4) Adjust screw speed to medium (Blue 9.0)

NOTE: The above is a general setting. Ultimate choice of fill speed should be one that completely fills and will consistently mold satisfactory parts. Faster fill speeds can cause short shots, burning of the plastic material or weld lines.

5) During cycling of machine and once normal screw rpm and heater band adjustments have reached optimum operating efficiency; adjust "back pressure" to approximately 100 psi to maintain a close control over stock temperature.

6) Adjust mold temperature controller to cool molded part (cool down for ejection).

NOTE: Minimum cycle time or extremely fast cool down of part is not always the optimum length cycle. The minimum cycle is often too sensitive to changes in ambient temperature. Increasing cycle times of only one or two seconds can increase reject rates considerably.

4. Molding Operations (Continued)

7) Check part ejection system as cycling commences to insure against "pile ups".

(h) Consult Figure No. 11 for complete molding specifications.

NOTE: The above is general information based on experience; however, "values can change with varying conditions, materials, part design, etc." The molder must make any adjustments or alterations as the molded sampling indicates necessary. Table III is provided to aid in troubleshooting molding problems.

5. Machining Operations

Drill and tap required holes per Drawing SM-D-453952.

6. Assembly Operations

(a) Install gasket SM-A-435954 to the panel using RTV-108 as supplied by General Electric.

(b) Install two (2) support brackets to underside of panel (slip fit only brackets will be secured at radio installation). Bracket P/N's are SM-A-435967 and SM-A-435968.

(c) Fill instrument identification lettering using florescent white paint on top side of panel.

7. Mold Maintenance

(a) Use dry air to blow out cooling channels.

(b) Core and cavity areas are sprayed with commercial rust preventative.

(c) Close mold and place in an assigned position in mold storage rack. Mold storages are located in an air conditioned area.

2-26-75

PLASTIC DEPT. INTERSHOP ORDER

Eagle Picher (Joplin) — Customer — 19-31-412-2 — Final Assembly Number — Panel — Part No. — Intershop No.

INTERSHOP ORDER NO.	PART NUMBER 19-31-412-2	MATERIAL CODE NUMBER 060-1205-60 (060-1205-60)			
QUANTITY TO PRODUCE	PRINT REVISION	MATERIAL DESCRIPTION Lexan 101,3015 Dk. Green			
DATE ISSUED	DATE DUE				
MATERIAL FOR THIS ORDER	COLOR				
MATERIAL STATUS	CUSTOMER P.O. NUMBER	NET WEIGHT PER PART 260.0 GR.	SHOT WEIGHT OZ.	QUOTED MACHINE 300 Reed	(30oz. cylinder)
	HOURS REQD. TO PRODUCE ORDER	NO. CAVITIES IN MOLD 1	MOLD NUMBER	QUOTED CYCLE 75 SEC.	QUOTED SET-UP TIME .64207

HEAT ZONES	MOLDING MACHINE 300 Ton			TIMER SETTINGS	MOLDING MACHINE 300 Ton			HYDR. PRESSURE	MOLDING MACHINE 300 Ton		
NOZZLE CODE NO.				PLUNGER FORWARD	17			FIRST STAGE	499		
NOZZLE	510			DIES CLOSED	43			SECOND STAGE	554		
FRONT	490			DELAY UNLOAD	9.9			SCREW SPEED RANGE	Med.		
CENTER	490			DIES OPEN	5 Safety			SCREW BACK P.S.I.			
REAR	460			DECOMPRESS	Rear			FEED SETTING	2 3/4"		
MANIFOLD				STUFFING				SCREW RETRACTION	18 sec.		
MOLD TEMP. STATIONARY				PLUNGER ADVANCE				RAM IN MOTION	3 sec.		
MOLD TEMP. MOVING	125			CYCLE SECONDS				SCREW SPEED SETTING	Blue 9		
MOLD TEMP. SLIDES				RATE PARTS/HR				INSPECTION SPEC. SETTING	Silver 5		
CYL. WATER TEMP.	150				.016666			MELT TEMP.			

OPER. NO.	TOOLS REQUIRED	TOOL LOC.	DESCRIPTION OF OPERATIONS	INSP.	SET-UP TIME HRS.	SET-UP TIME DATE & I
1	Mold		Injection mold (1) part per cycle.			
2			Box for shipment.			
					TEAR-DOWN TI HRS.	TEAR-DOWN TI DATE & I

PACKAGING INSTRUCTIONS

FIGURE NO. 11

GROSS _____ BOX NO. _____

TARE _____ QTY. PER BOX _____

NET _____

START	DATE & INITIAL	STOP	DATE & INITIAL	TOTAL HOURS

FINISH DATE

EXACT QTY. PRODUCED

D. Panel, Local (SM-D-435953)

1. Manpower and Space Required

OPERATION	DESCRIPTION	MAN MINUTES REQUIRED PER LOT	PER PART
Set-Up Time	Time Required to Get Equipment Ready for Molding	480	
Molding Time	Actual Time Needed to Mold the Part		1.25
Drilling and Tapping Operation	Drill and Tap Holes for Hardware		10
Assembly	Install Gasket and Bracket Fill Lettering		15
	TOTAL	480	26.25

MOLDER: Western Controls
2533 Southwest Street
P. O. Box 1202
Wichita, Kansas 67201

Floor Space Available: Approximately 50,000 sq. ft.

Floor Space Needed: 5,000 sq. ft.

2. *Equipment, Tools, Jigs and Fixtures Required*

(a) Mold - 19-31-412-1

(b) Molding Machine - Reed, Model 300, Reciprocating Screw, 30 oz., 350 ton maximum for preparing resin for injection into mold.

(c) Oven - Size and temperature range to meet production requirements. Used to dry the resin previous to molding.

(d) Scales - For weighing moisture content of material. Type and capacity to meet application.

(e) Drill Press - Type and size dependent on production rate. (Used to drill holes as required)

(f) Drill Jig - For positioning holes (19-31-412-1).

3. Material Required

(a) Polycarbonate (unfilled)

(b) Lexan 101-SE

(c) Form - Pelletized (Custom Color 3015, Dk. Green)

4. Molding Operations

(a) Drying - Place stock material in oven or in hopper dryer. Adjust temperature to 170-190°F. Dry stock material until there is less than .05 of 1% moisture by weight.

(b) Fill hopper (if stock material was dried in an oven) with resin.

(c) Preheat mold to 160°F.

(d) Stabilize stock material from 470 to 520°F depending on existing conditions (plastication). This is done by the heater band elements located within the mold cylinder. Slight readjustment may be necessary as cycling of mold progresses.

(e) Regulate nozzle temperatures at 520°F.

(f) Meter stock into cylinder and regulate temperature of stock as follows.

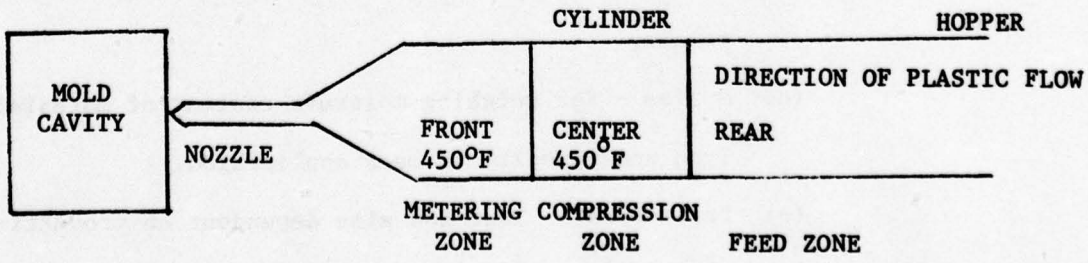


FIGURE NO. 12

4. Molding Operations (Continued)

(g) Fill mold cavity and make following adjustments during cycling.

1) Injection Pressure 10,000 - 20,000 psi

2) Shot Weight should be 300 grams

3) Regulate fill speed at 3 3/4 inches.

4) Adjust screw speed at low range - B-7.

NOTE: The above is a general setting. Ultimate choice of fill speed should be one that completely fills and will consistently mold satisfactory parts. Faster fill speeds can cause short shots, burning of the plastic material or weld lines.

5) During cycling of machine and once normal screw rpm and heater band adjustments have reached optimum operating efficiency; adjust "back pressure" to approximately 100 psi to maintain a close control over stock temperature.

6) Adjust mold temperature controller to cool molded part (cool down for ejection).

NOTE: Minimum cycle time or extremely fast cool down of part is not always the optimum length cycle. The minimum cycle is often too sensitive to changes in ambient temperature. Increasing cycle times of only one or two seconds can increase reject rates considerably.

4. Molding Operations (Continued)

7) Check part ejection system as cycling commences to insure against "pile ups".

(h) Consult Figure No. 13 for complete molding specifications.

NOTE: The above is general information based on experience; however, "values can change with varying conditions, materials, part design, etc." The molder must make any adjustments or alternations as the molded sampling indicates necessary. Table III is provided to aid in troubleshooting molding problems.

5. Machining Operations

Drill and tap required holes per Drawing SM-D-453952.

6. Assembly Operations

(a) Install cover gasket SM-A-435954 to the panel using RTV-108 as supplied by General Electric.

(b) Install one (1) support bracket to underside of panel. (Slip fit only. Brackets will be secured at radio installation). Bracket part number is SM-A-435968.

(c) Fill instrument identification lettering on top side of panel with florescent white paint.

7. Mold Maintenance

(a) Use dry air to blow out cooling channels.

(b) Core and cavity areas are sprayed with commercial rust preventative.

(c) Close mold and place in an assigned position in mold storage rack. Mold storages are located in an air conditioned area.

2-28-75

PLASTIC DEPT. INTERSHOP ORDER

Eagle Pitcher (Joplin) Panel — Contract — Part # 19-31-412-1

INTERSHOP ORDER NO.	PART NUMBER 19-31-412-1	MATERIAL CODE NUMBER 060-1205-60			
QUANTITY TO PRODUCE	PRINT REVISION				
DATE ISSUED	DATE DUE	MATERIAL DESCRIPTION Lexan 101, 3015 Dk. Green.			
MATERIAL FOR THIS ORDER	COLOR				
MATERIAL STATUS	CUSTOMER P.O. NUMBER	NET WEIGHT PER PART 300.0 GR.	SHOT WEIGHT OZ.	QUOTED MACHINE 300 Reed	.53740 (30 oz. cylinder)
	HOURS REQD. TO PRODUCE ORDER	NO. CAVITIES IN MOLD 1	MOLD NUMBER	QUOTED CYCLE 75 S.	QUOTED SET-UP TIME

HEAT ZONES	MOLDING MACHINE C-6 275			TIMER SETTINGS	MOLDING MACHINE C-6 275			HYDR. PRESSURE	MOLDING MACHINE C-6 275		
NOZZLE CODE NO.	X			PLUNGER FORWARD	16			FIRST STAGE	1200		
NOZZLE	520			DIES CLOSED	30			SECOND STAGE	1000		
FRONT	470			DELAY UNLOAD	7			SCREW SPEED RANGE	Low		
CENTER	480			DIES OPEN				SCREW BACK P.S.I.			
REAR	470			DECOMPRESS				FEED SETTING	3 3/4"		
MANIFOLD				STUFFING				SCREW RETRACTION			
MOLD TEMP. STATIONARY	Chiller			PLUNGER ADVANCE				RAM IN MOTION			
MOLD TEMP. MOVING	Chiller			CYCLE SECONDS	55			SCREW SPEED SETTING	B-7		
MOLD TEMP. SLIDES				RATE PARTS/HR				INSPECTION SPEED SETTING	Slow		
CYL. WATER TEMP.					.01666			MELT TEMP.			

OPER. NO.	TOOLS REQUIRED	TOOL LOC.	DESCRIPTION OF OPERATIONS	INSP.	SET-UP TIME HRS.	SET-UP TIME DATE & INITIAL
1	Mold		Injection mold (1) part per cycle.			
2			Box for shipment.			
					TEAR-DOWN TIME HRS.	TEAR-DOWN TIME DATE & INITIAL

PACKAGING INSTRUCTIONS

FIGURE NO. 13

GROSS _____ BOX NO. _____

TARE _____ QTY. PER BOX _____

NET _____

START	DATE & INITIAL	STOP	DATE & INITIAL	TOTAL HOURS

FINISH DATE

EXACT QTY. PRODUCED

TABLE NUMBER VII

TROUBLE SHOOTING

As an example of how to use the trouble shooting chart, assume the problem in question is poor surface finish on the molded part. Under the column titled "poor surface finish" read downward until you find remedy #1. This will indicate the easiest possible solution to the problem. If predrying does not correct the situation, use remedy #2 in the same column. Afterwards, if the problem still remains, subsequent remedies are prescribed until the condition is corrected. The same procedure is followed to trouble-shoot other abnormal conditions listed.

Color Streaking	Short shots	Sink marks	Flash	Weak weld	Brittleness	Poor surface finish	Blush at gate	Jetting	Weld burns	Lamination	Warpage	Wave marks	Poor dimensional stability	Drag marks	Sticking in cavity	Sprue sticking	SUGGESTED REMEDIES
	2	2		4	5	2	3				5	2					Increase injection pressure
4			2			6			5		3		3	2	3		Decrease injection pressure
	7	6									8	7	7				Increase cycle time
	6	5				8	6				4	6	5		5		Increase injection hold-time
			3						4					3	4	1	Decrease injection hold-time
10	8	7		7	7	14	9	7		8			11		7		Increase sprue, runner or gate size
	10			6	6	13	8			6			10		6		Decrease gate land area
9	9			5		12	7	5		5			8				Use larger opening in nozzle
2	1	1									1	1	1				Adjust feed
			5									5					Increase clamp pressure
1	5			3	3	5				3	2		2				Increase stock temperature
1		3	1		4	3	4	2	1		7	3			2		Decrease stock temperature
6	3			1	2	4	2	3	3	2			4			2	Increase mold temperature
		4									6	4			1		Decrease mold temperature
		9				18					11	8	12				Change location of water channels
			6														Re-match mold parting line
						15	12		7								Add more gas vents
3					1	1	1	1		1							Pre-dry material
11	11	8		8		17	11	8					9				Change location of gate
						10								1	8		Polish surface of mold
						16	10	6		7							Increase depth or dia. of cold slug well
	4			2													Increase injection speed
5			4			7	5	4	2	4	9		6				Decrease injection speed
																3	Re-seat nozzle
8									6								Check nozzle heating band
						11											Polish sprue, runners & gates
7				9	8	9				9							Check material for contamination
											10						Use clamping or shrink fixtures
																5	Polish sprue bushing
																4	Check sprue puller for defects & correct

12

APPENDIX

MOD COL					DATA LIST	DEPARTMENT OF DEFENSE U.S. ARMY ELECTRONICS COMMAND FORT MONMOUTH, NEW JERSEY 07703		REVISION		
				DAABO5-73-2081				LTR	DATE	APVD
					LIST TITLE Radio Set C-2328A/GRA-39 C-2329A/GRA-39	CODE IDENT 80063	SHEET 1 OF 2 SHEETS			
					PII NO.	AUTH	REVD	DATE 24 June 1974		

5	4	3	2	1	CODE IDENT	DWG SIZE	DOCUMENT NUMBER	NO. SH	REV LTR	NOMENCLATURE OR DESCRIPTION
				*	80063	D	SM-D-435949			Cover
				*		C	SM-C-435950			Lettering Detail
				*		C	SM-C-435951			Lettering Detail
				*		D	SM-D-435952			Panel
				*		D	SM-D-435953			Panel
				*		A	SM-A-435954			Gasket, Panel
				*		D	SM-D-435955			Case Assembly
				*		D	SM-D-435956	2		Panel Assembly
				*		D	SM-D-435957	2		Panel Assembly
				*		D	SM-D-435958			Control Radio Assembly (C-2328A)
				*		D	SM-D-435959			Control Radio Assembly (C-2329A)
				*		D	SM-D-435960			Cover Assembly
				*		B	SM-B-435961			Label, Battery Installation
				*		B	SM-B-435962			Buckle
				*		B	SM-B-435963			Buckle
				*		B	SM-B-435964			Buckle
				*		B	SM-B-435965			Pad
				*		B	SM-B-435966			Label, Identification
				*		A	SM-A-435967			Support Bracket
				*		A	SM-A-435968			Support Bracket
				*		A	SM-A-435969			Gasket, Cover

MOD CODE

DAAB-05-73-2081

DATA LIST

DEPARTMENT OF DEFENSE
U.S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH, NEW JERSEY 07703

REVISION		
LTR	DATE	APVD

LIST TITLE: Radio Set C-2328A/GRA-39 C-2329A/GRA-39

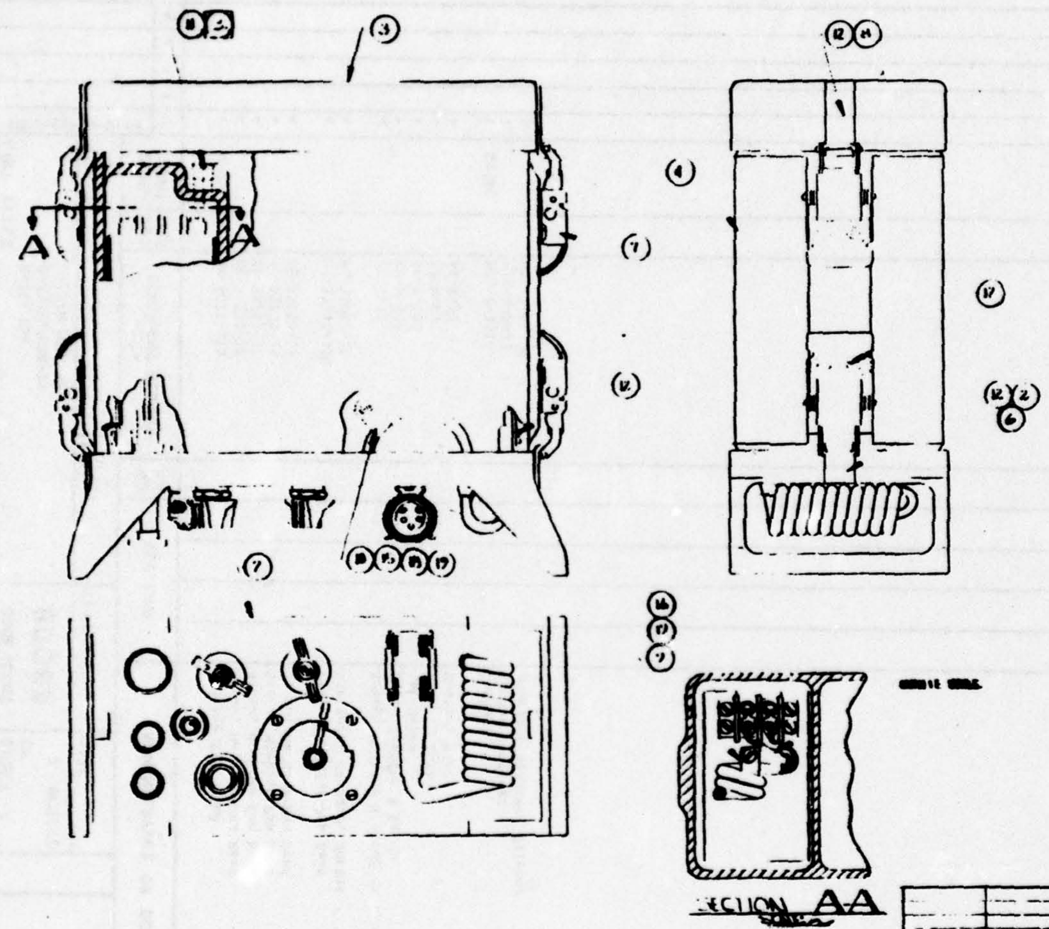
CODE IDENT: 80063

SHEET 2 OF 2 SHEETS

PII NO. | AUTH | REVD | DATE

5	4	3	2	1	CODE IDENT	DWG SIZE	DOCUMENT NUMBER	NO. SH	REV LTR	NOMENCLATURE OR DESCRIPTION
				*	96906		MS-9021-016			Packing Preformed
				*			MS-35233-28			Screw, Machine-Pan Head
				*			MS-35233-27			Screw, Machine-Pan Head
				*			MS-35233-25			Screw, Machine-Pan Head
				*			MS-35233-13			Screw, Machine-Pan Head
				*			MS-35237-328			Screw, Machine-Pan Head
				*			MS-51021-10			Set Screw Hexagon, Socket
				*			FF-S-92			Screw, Machine Slotted or Cross-Recessed
				*			FF-S-107			Screw Tapping & Drive
				*			FF-S-200			Set Screw
				*			FF-W-84			Washer, Lock
				*			FF-W-92			Washer, Flat
				*	81349		MIL-P-5516			Packing
				*			MIL-A-8623			Anodic Coatings
				*			MIL-A-46106			Adhesive Sealant, Silcone

ARADCOM Form (1 Jan 73) 8034 (Previous edition may be used until exhausted)



NOTES:

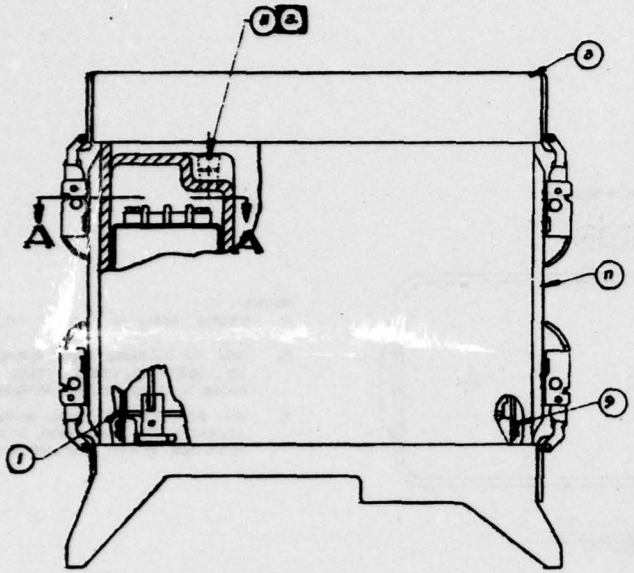
1. FOR SCHEMATIC, SEE SM-D-[illegible]75.
2. MAY BE OBTAINED FROM AMERICAN SEALANTS CO., HARTFORD 6, CONN., [illegible] PART NO. "GRADE A, CLASS 20, OR EQUAL.
3. DO NOT INSTALL FIND NO. 11 AND 3 UNTIL AFTER VACUUM TEST.
4. APPLY A LIGHT COATING OF INSULATING COMPOUND DC 4 TO COVER ASSEMBLY AND PANEL ASSEMBLY GASKETS-FEDERAL SPEC. [illegible] 5970-SBV-7984.
5. COLOR [illegible] FRONT PER FED STD-595

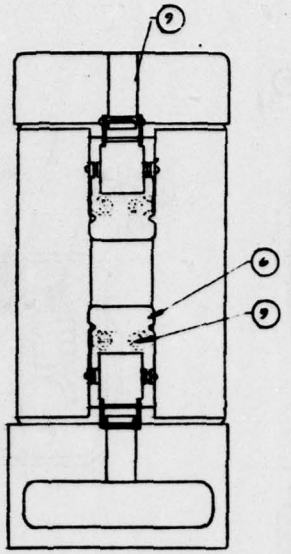
17	2			GROMMET, [illegible]	[illegible]		[illegible]
18	1			SCR, MACH, PAN HD.	[illegible]		[illegible]
17	4			SCR, MACH, PAN HD.	[illegible]		[illegible]
16	1			SCR, MACH, PAN HD.	[illegible]		[illegible]
15	1			WASHER, FLAT	[illegible]		[illegible]
14							
13							
12	22			SCR, [illegible], PAN HD.			
11	1			PLUG, PIPE			[illegible]
10	1			CLAMP, CABLE			[illegible]
9	1			CLAMP			[illegible]
8	2			BUCKLE			[illegible]
7	4			LATCH			[illegible]
6	2			BUCKLE			[illegible]
5	1			[illegible] ASSEMBLY			[illegible]
4	1			CASE ASSEMBLY			SM-D-435755
3	1			COVER ASSEMBLY			SM-D-4357[illegible]
2	1			PANEL ASSEMBLY			SM-D-435756
1	1			CHASSIS ASSEMBLY			[illegible]

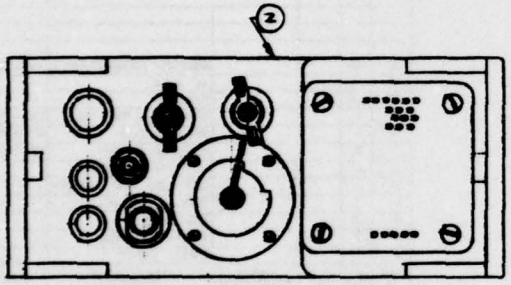
PARTS LIST

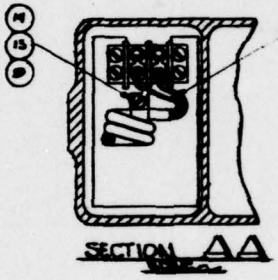
CONTROL ASSEMBLY
RADIO SET
C 7329A/GRA-39

B 80063 SM-D-435959









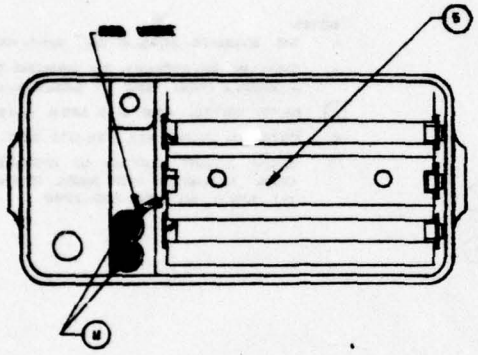
NOTES:

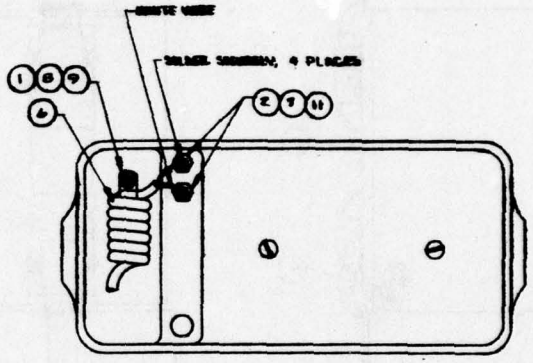
1. PER SCHEMATIC DIAGRAM SEE SM-D-450716
2. SHALL BE AS SUPPLIED BY AMERICAN SEALANTS CO., HARTFORD 6, CONN., 7468 PERT LM GRADE A, CLASS 20, OR EQUAL.
3. DO NOT INSTALL ITEMS 10 AND 11 UNTIL AFTER VACUUM TEST.
4. COLOR LM 24087 PER FED-STD-595
5. APPLY A LIGHT COATING OF LUBRICATING COMPOUND DC 4 TO COVER ASSEMBLY AND PANEL ASSEMBLY GASKETS FSN 5330-382-7944

ITEM	QTY	REF DES	USABLE ON CODE	DESCRIPTION	PART NO.	MFR CODE	
17	1			CASE ASSEMBLY			
16							
15							
14	1			SCR, MACH, PAN HD	FF-S-92		
13	1			WASHER, LOCK	FF-W-84		
12							
11	1			PLUG, PIPE			
10	9						
9	22			SCR, MACH, PAN HD.	FF-S-92		
8	1			CLAMP			
7	1			PLATE, IDENTIFICATION			
6	4			GASKET			
5							
4	1			WIRING ASSEMBLY			
3	1			COVER ASSEMBLY			
2	1			PANEL ASSEMBLY			
1	1			CHASSIS ASSEMBLY			

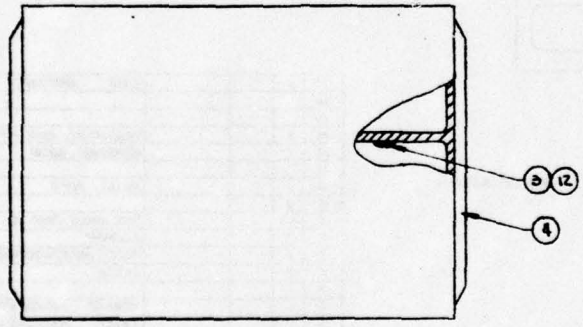
CONTROL ASSEMBLY
RADIO SET
C-232BA / GRA-39

D 80063 SM-D-435258





VIEW A-A



A

A

NOTES:

1. SOLDER SHALL BE SN 60 WW.P.S, MIL-[illegible]
2. MAY BE OBTAINED FROM AMERICAN SEALANTS CO., HARTFORD, CONN., THEIR PART NO. GRADE A, CLIMAX CO, OR APPROVED EQUAL.
3. MAY BE OBTAINED FROM COMMUNICATION PRODUCTS CO., AMELSBORO, N.J., THEIR PART NO. A-27, OR APPROVED EQUAL.

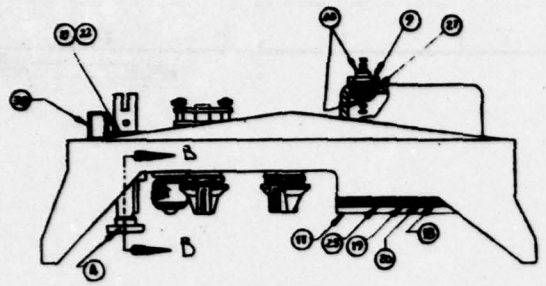
ITEM NO.	QTY. REQUIRED	CAGE IDENT.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL OR GOVT.	SPARE
12	AR			ADHESIVE (EPOXIED WIRE)	MIL-A-8625		
11	AR			6" MIN			
10	AR			SOLDER			
9	1			SCR, BRASS, PAN HD	FF-S-92		
8	1			WASHER, FLAT	FF-W-92		
7	2			PACKARD, O' RING	MIL-P-5516		
6	1			CON. CORD ASSEMBLY			
5	1			BATTERY BOX ASSEMBLY			
4	1			CASE (ASSEMBLY)			
3	2			SCR. SCREW			
2	2			TERM FEED THRU			
1	1			CABLE, CLAMP			

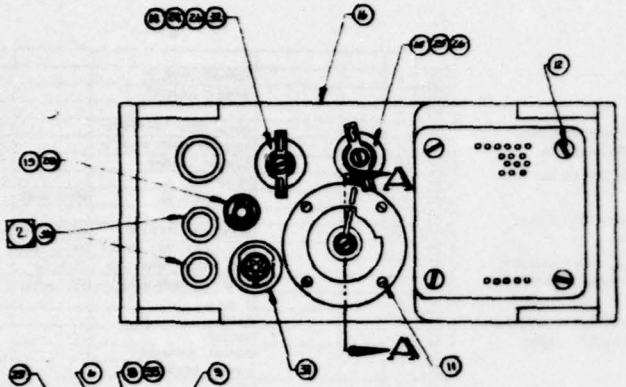
PARTS LIST

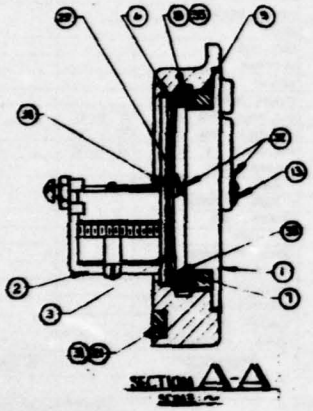
SIZE	CAGE CODE NO.
B	80063

CASE ASSEMBLY

SMD-435955







SECTION A-A

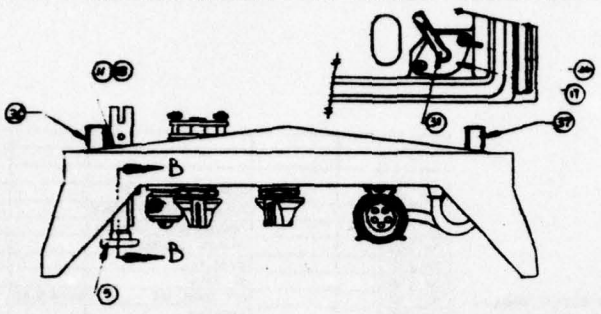
SECTION B-B

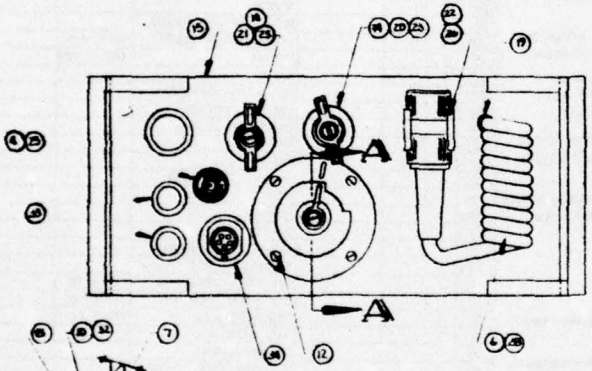
NOTES:

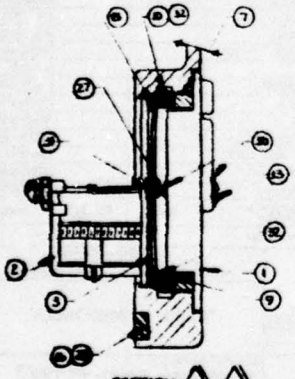
1. MAY BE OBTAINED FROM MINNESOTA MINING & MFG CO., THESE PARTS ARE SC-TH, OR APPROVED EQUAL.
2. INSTALL PART NO. 36 SO THAT WIRE INSERTION SLOTS ARE PARALLEL TO BOTTOM OF PANEL.
3. MAY BE OBTAINED FROM DOW CORNING CORP., MIDLAND, MICH., THESE PARTS ARE RTV 731, OR RTV91, OR APPROVED EQUAL.
4. MAY BE OBTAINED FROM DOW CORNING CORP, MIDLAND, MICH., THESE PARTS ARE DC 35, OR APPROVED EQUAL.
5. MAY BE OBTAINED FROM COMMUNICATIONS PRODUCTS CO., MARLBORO, N.J., THESE PARTS ARE A-27, OR APPROVED EQUAL.
6.
7. FOR ASSEMBLY OF PART NO. SC-C-16493.
8. FOR ASSEMBLY OF PART NO. 37, SEE DRAWING NO. SM-C-
9. DEPTH OF PART NO. 29 TO BE DETERMINED BEFORE APPLYING PART NO. 32.

ITEM NO.	QTY REQD.	ZONE LTR.	PART OR IDENTIFYING NO.	DESCRIPTION OF ITEM	MATL	FINISH OR SPEC	REMARKS
38	1			SUPPORT BRACKET			
37	1			CORD, REF U			
36	2			RIBBON PART 8-CR/U			
35	AR			SOLDER CERAMA		4.	
34	AR			SOLDER		3.	
33	AR			WIRE		2.	
32	AR			PCT BOARD 122	MIL-P-9232		
31	AR			MARKING		1.	
30	1			O RING			
29	1			SPEEDITE MTG BRACKET			
28	1			LAMP, RECESSED SOCKET	MIL-L-3661		
27	2			O RING	MIL-P 5516		
26	2			LAMP			
25	1			RESISTOR, VARIABLE			
24	1			SWITCH, ROTARY			
23	1			LOUDSPEAKER, PM			
22	1			NUT, HEX			
21	1			GRAFT			
20	1			PLATE (ALTERED)			
19	1			GASKET			
18	1			GASKET			
17	1			COVER			
16	1			PANEL (MARKED)			
15	1			HOUSING, LAMP ASSY			
14	2			SCR, MACH, PAN HD	FF-S-92		
13	1			SCR, MACH, PAN HD	FF-S-92		
12	4			SCR, MACH, FIL H	FF-S-92		
11	4			SCR, MACH, FIL H			
10	1			GROMMET, LOCK			
9	2			TERMINAL, FEED THRU			
8	1			O RING			
7	1			O RING, RETAINER			
6	1			SPACER, BASE			
5	1			BASE NUT			
4	1			PLUNGER ASSEMBLY			
3	1			DIAPHRAGM ASSEMBLY			
2	1			DIAL/LE ASSEMBLY			
1	1			COVER ASSEMBLY			

		PANEL ASSEMBLY	
		D 80063	SMD-435957







SECTION A-A

SECTION B-B

SECTION C-C

NOTES:

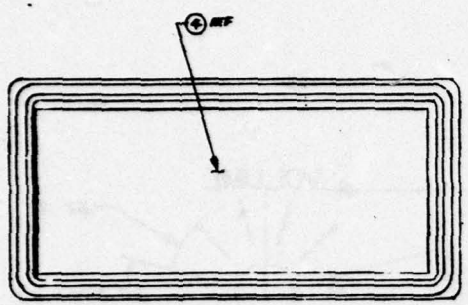
1. MAY BE OBTAINED FROM MINNESOTA MINING & MFG. CO., THEIR PART NO. EC 741, OR APPROVED EQUAL.
2. APPLY FIND NO. 26 TO FIND NO. 6 BEFOR INSERTING INTO FIND NO. 19
3. INSTALL FIND NO. 33 SO THAT WIRE INSERTION SLOTS ARE PARALLEL TO BOTTOM OF PANEL.
4. MAY BE OBTAINED FROM DOW CORNING CORP. MIDLAND MICH., THEIR PART NO. RTV 731 OR RTV 891, OR APPROVED EQUAL.
5. MAY BE OBTAINED FROM DOW CORNING CORP., MIDLAND MICH., THEIR PART NO. DC 33, OR APPROVED EQUAL.
6.
7. FOR DIMENSION OF FIND NO. 35, SEE DRAWING NO. SCC 10495
8. FOR DIMENSION OF FIND NO. 34 SEE DRAWING NO. SM-C-405681.
9. DEPTH OF FIND NO. 27 TO BE DETERMINED BEFOR APPLYING FIND NO. 30

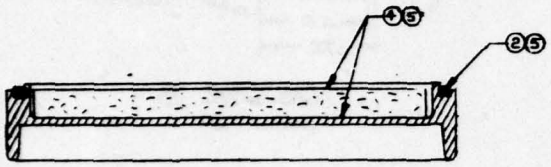
37	1			SUPPORT BRACKET				
36	1			SUPPORT BRACKET				
35	1							
34	1			CONN, RECP	D-783/D		01	
33	1			TERMINAL POST	D-806/D		5 & 7	
32	AR			SILICON GREASE			5.	
31	AR			SILASTIC			4.	
30	AR			PC BOARD 122		MIL-P-8629		
29								
28	AR			ADHESIVE RTV 118		MIL-A-46146	1, 12.	
27	1			SETSCREW HEX SOCKET		4-5 /32D		
26	1			SCR, MACH, PNH HD		1-5 92		
25	1			LAMP, INCAND SLIDE		MIL L 6363		
24	1			O' RING				
23	2			GUIDE				
22	1			HOLDER				
21	1			SWITCH, ROTARY				
20	1			SWITCH, ROTARY				
19	1			BODY			2.	
18	1			NUT, HEX				
17	1			RETAINER				
16	1			GASKET				
15	1			PANEL (MARKED)				
14	1			SCR, MACH, PNH HD		89-5-92		
13	1			SCR, MACH, PAN HD		89-5-92		
12	6			SCR, MACH, FIL HD		89-5-92		
11	1			WASHER, LOCK				
10	1			O' RING				
9	1			O' RING RETAINER				
8	1			SPACER, RING				
7	1			RING NUT				
6	1			CIRCUIT ASSEMBLY			2.	
5	1			PLUNGER ASSEMBLY				
4	1			HOUSING, LAMP ASSY				
3	1			DIAPHRAGM ASSEMBLY				
2	1			BUZZER ASSEMBLY				
1	1			CABLE ASSEMBLY				

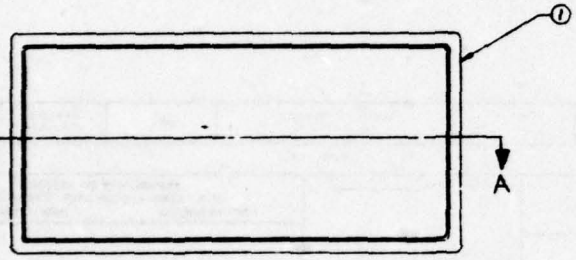
PANEL ASSEMBLY

D 80063 SM-D-435958

SHEET 1/1







ITEM NO.	QTY REQD.	CODE IDENT.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL OR SIZE	SPEC
5	AR.			ADHESIVE (RTV-118)			
4	1			PAD			SM-D-435340
3							
2	1			GASKET			SM-D-435347
1	1			COVER			SM-D-435349

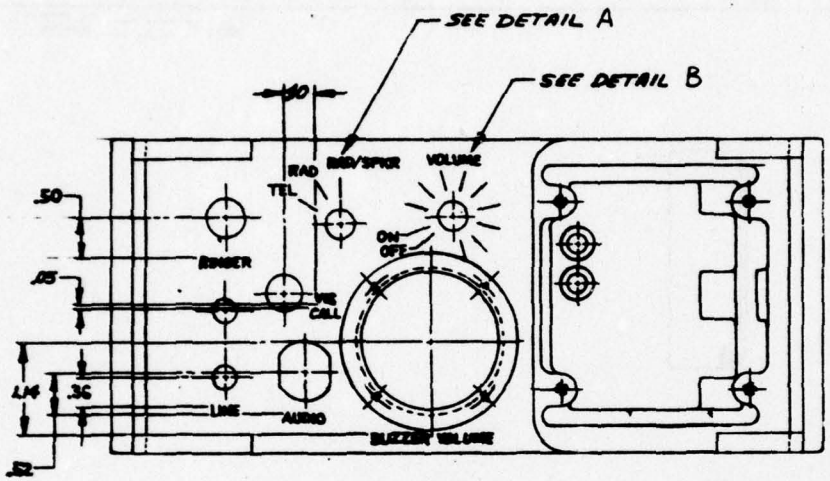
PARTS LIST

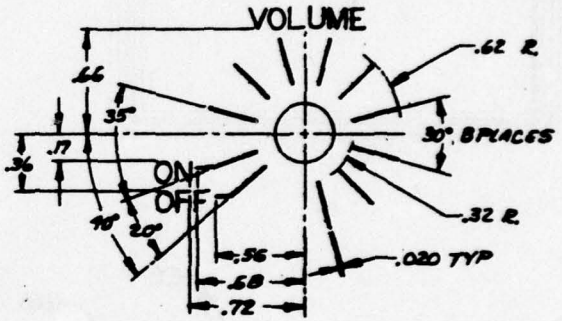
CONTRACT NO.	
DATE	
APPROVED	
DRAWN	
CHECKED	
ENGINEER	

COVER ASSEMBLY

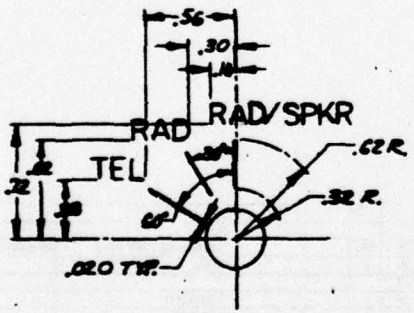
SIZE	CAGE IDENT NO.	SM-D-435340
B	80063	

SCALE Vi





DETAIL B
SCALE 2/1



DETAIL A
SCALE 2/1

NOTES:
1. MARKING TO BE IN ACCORDANCE WITH GROUP I OF MIL-M-13231.
2. LINE WIDTH: CHARACTERS & LINES TO BE .020 WIDE × .015 DEEP.
3. CHARACTERS TO BE 12 POINT.

ITEM	QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL OR NOTE	EP NO

PARTS LIST

	CB/30 RADIO
NEXT ASSY	USED ON
APPLICATION	

CONTRACT NO.

DATE

PREPARED	B. MILLER	7-16-74
CHECKED		
ENGINEER		7-16-74

MATERIAL

DEPARTMENT OF DEFENSE
U.S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

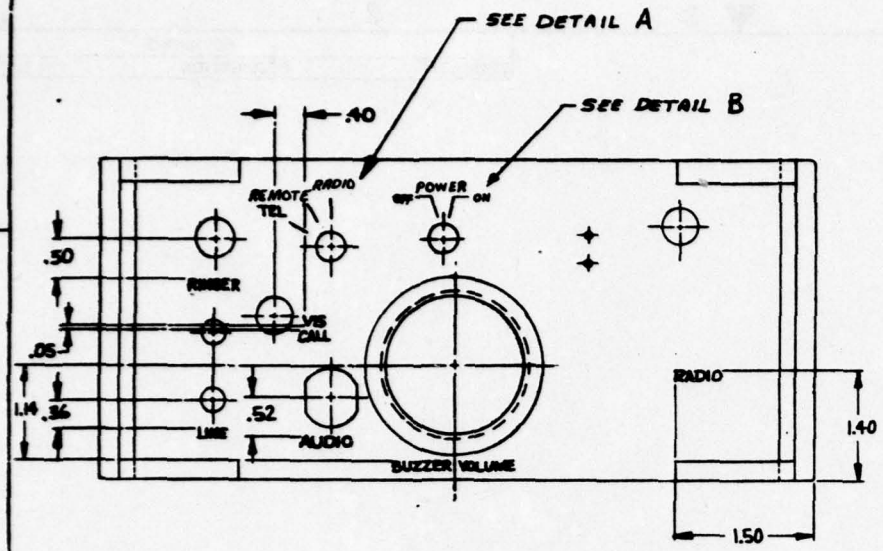
LETTERING DETAIL

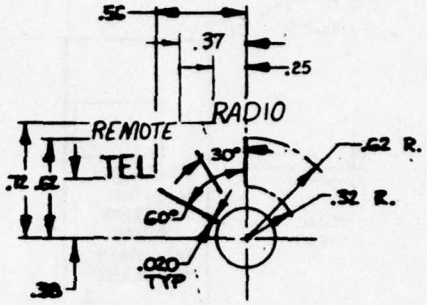
SIZE	CODE IDENT NO.	
C	80063	SM-C-435951

SCALE 1/1 SHEET 1 OF 1

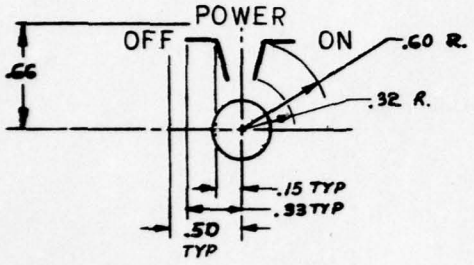
SMC-435951

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED





DETAIL A
SCALE 2/1



DETAIL B
SCALE 2/1

NOTES:
1. MARKING TO BE IN ACCORDANCE WITH GROUP I OF MIL-M-13231.
2. LINE WIDTH: CHARACTERS & LINES TO BE .020 WIDE x .015 DEEP.
3. CHARACTERS TO BE 12 POINT.

DWG NO SM-C-435950

FIND NO.	QTY REQD.	CODE IDENT.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPEC	MATERIAL OR NOTE	EP NO

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONAL ± ANGULAR ± 2PL ± 3PL ±.010

MATERIAL

CONTRACT NO.

DATE

PREPARED	B. NIDLER	7-15-74
CHECKED		
ENGINEER	D. Nadler	7-15-74

DEPARTMENT OF DEFENSE
U.S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

LETTERING DETAIL

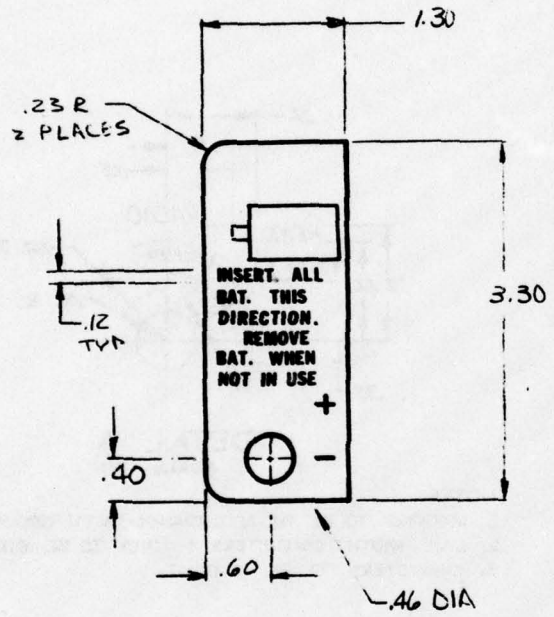
NEXT ASSY	USED ON
	CRA/39 RADIO

APPLICATION

SIZE	CODE IDENT NO.	
C	80063	SM-C-435950

SCALE 1/1 SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



SM-D-450170	GRA/39 RADIO
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS DECIMALS ANGLES
±1/32 2PL ± .03 3PL ± .010 ±2°

MATERIAL: MYLAR
ADHESIVE BACK

CONTRACT NO.

DATE

PREPARED

CHECKED

ENGINEER

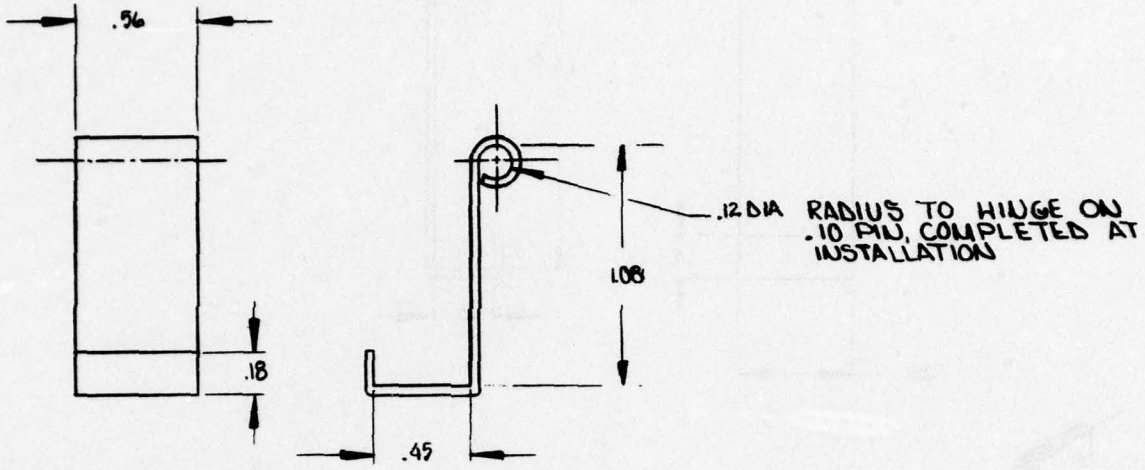
DEPARTMENT OF DEFENSE
U.S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

LABEL,
BATTERY INSTALLATION

SIZE	CODE IDENT NO.	
B	80063	SM-B-435961

SCALE 1/1 SHEET

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



SCALE: 1/1

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS ±1/32 DECIMALS 2 PL ± .03, 3 PL ± .010 ANGLES ±2°

MATERIAL: .05-.06 S.S.

CONTRACT NO.

DATE

PREPARED	[redacted]	4-2-76
CHECKED		
ENGINEER		

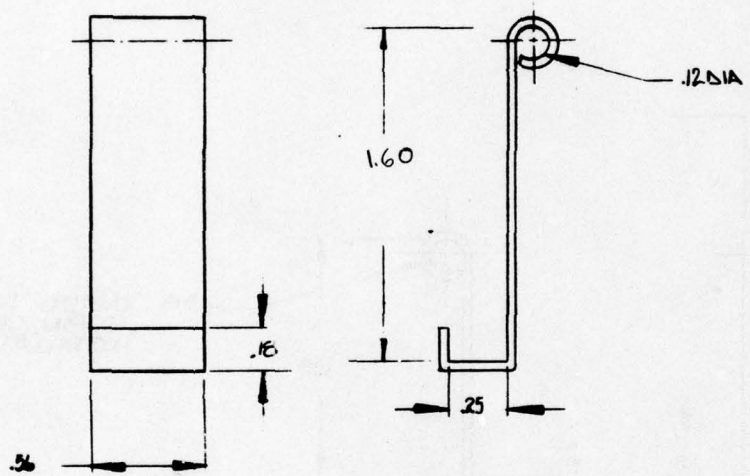
DEPARTMENT OF DEFENSE
U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

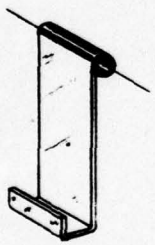
BUCKLE

SIZE	CODE IDENT NO.	
B	8	SM-B-435963
SCALE 2/1		SHEET

19-31-412-6

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED





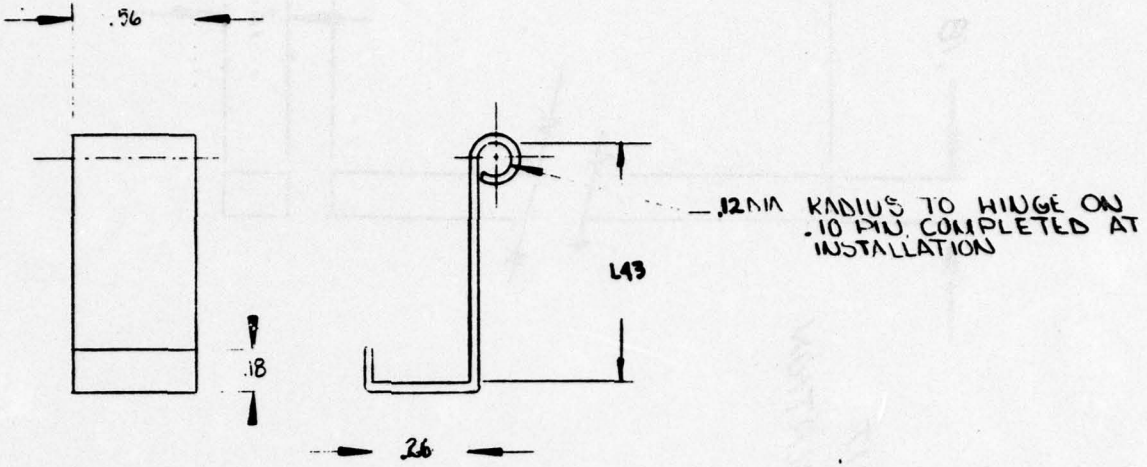
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONS DECIMALS ANGLES ±1/32 2 PL ± .03 3 PL ± .010 ±2°	CONTRACT NO. DATE	DEPARTMENT OF DEFENSE U.S. ARMY ELECTRONICS COMMAND FORT MONMOUTH NEW JERSEY 07703
		MATERIAL: .05-.06 S.S.	PREPARED 4-2-76 CHECKED ENGINEER	BUCKLE
NEXT ASSY	USED ON			SIZE B CODE IDENT NO. 8 SM-B-435964
APPLICATION				SCALE 2/1 SHEET

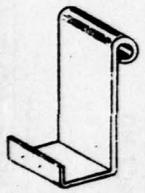
19-31-412-8

5	4	3	2	1

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED





NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON FRACTIONS DECIMALS ANGLES
±1/32 2PL ± .03 3PL ± .010 ±2°

MATERIAL: .05-.06 S.S.

CONTRACT NO.

DATE

PREPARED	[redacted]	4-2-76
CHECKED		
ENGINEER		

DEPARTMENT OF DEFENSE
U.S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

BUCKLE

SIZE	CODE IDENT NO	
B	80063	SM-B-435962

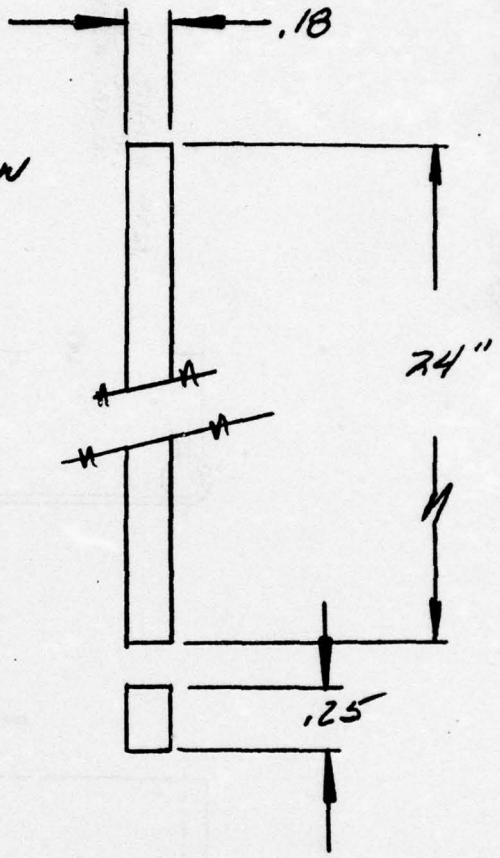
SCALE ~ SHEET

19-31-412-7

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
SM-D-435949	GRA/39 B				

NOTES:

1. GASKET SHALL BE CUT TO LENGTH AT INSTALLATION

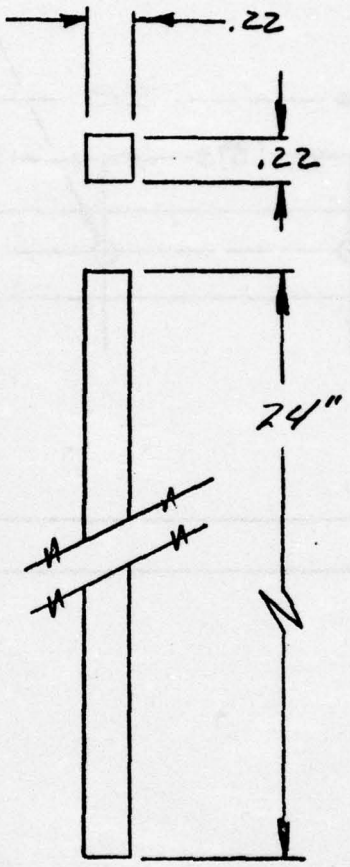


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ±.010 2 PLACE DECIMALS ±.03	CONTRACT NO. DATE _____	DEPARTMENT OF DEFENSE U. S. ARMY ELECTRONICS COMMAND FORT MONMOUTH NEW JERSEY 07703
MATERIAL R 431 N SCE-43-BLACK	PREPARED [redacted] 24 Feb 75 CHECKED ENGINEER	GASKET, COVER
		SIZE A | CODE IDENT NO. 80063 | DRAWING NO. SM-A-435969
		SCALE ~ | | SHEET

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
SM-D-435956	GRA/39B				
SM-D-435957					

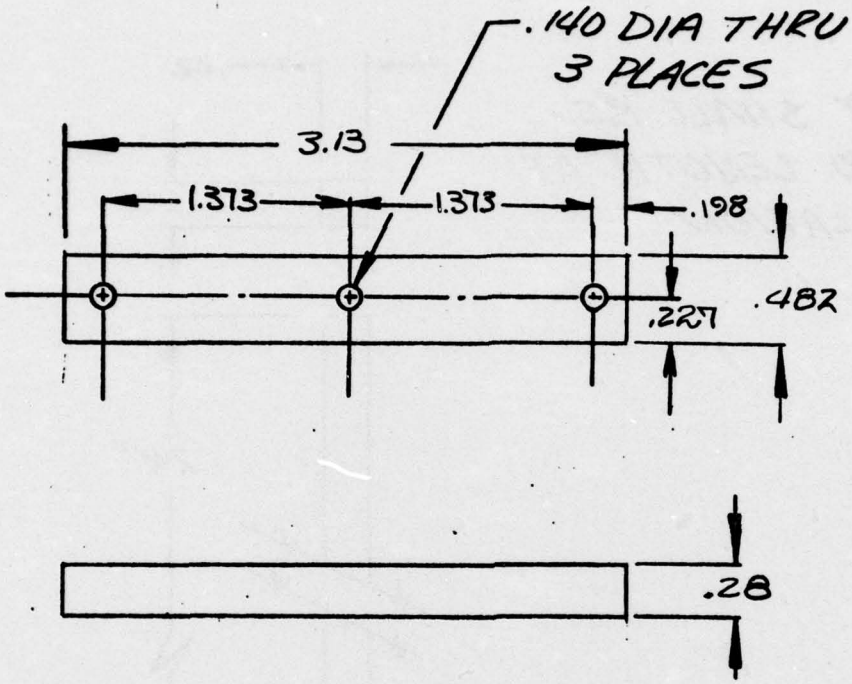
NOTES:

1. GASKET SHALL BE CUT TO LENGTH AT INSTALLATION



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ±.010 2 PLACE DECIMALS ±.03	CONTRACT NO. DATE _____	DEPARTMENT OF DEFENSE U. S. ARMY ELECTRONICS COMMAND FORT MONMOUTH NEW JERSEY 07703
MATERIAL R 431 N SCE-43-BLACK	PREPARED [illegible] 24 Feb 75 CHECKED ENGINEER	GASKET, PANEL
		SIZE A | CODE IDENT NO. 80063 | DRAWING NO. SM-A-435954
		SCALE 2 | SHEET

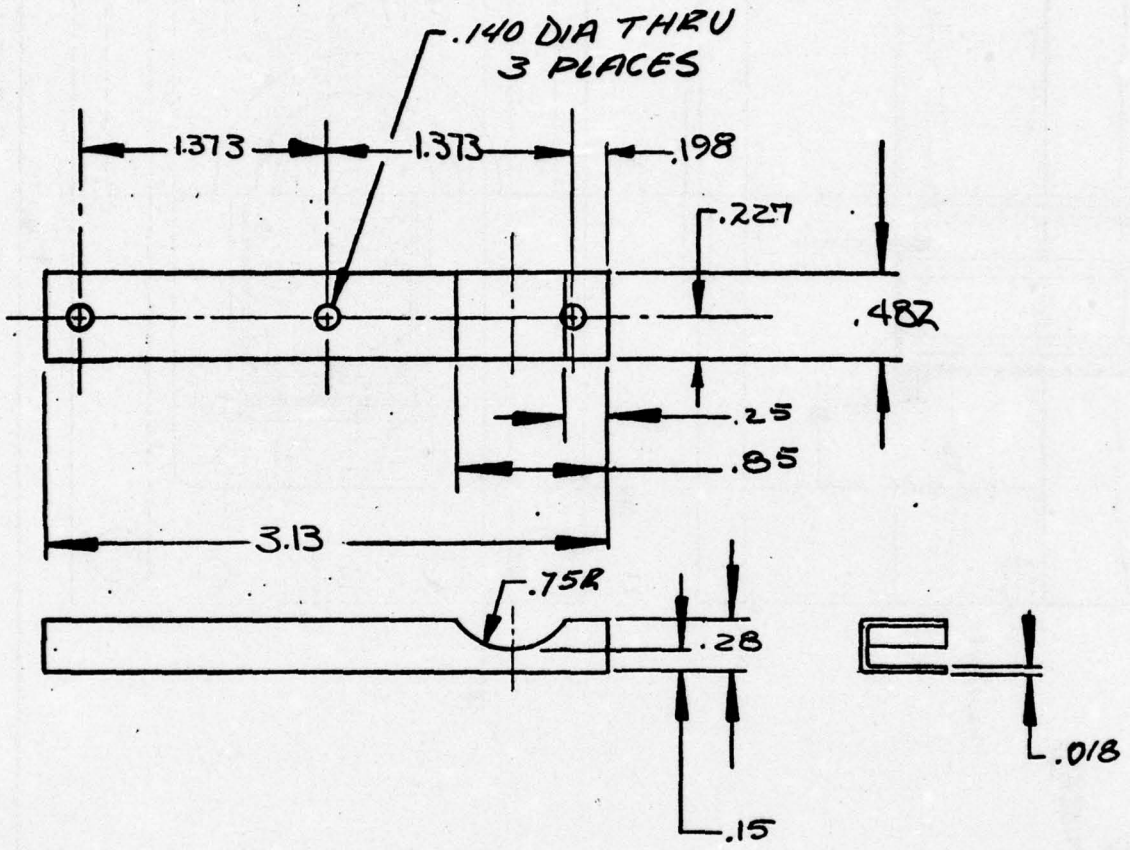
APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
SM-D-435953	GRA/39B				
SM-D-435952					



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ±.010 2 PLACE DECIMALS ±.03	CONTRACT NO. DATE	DEPARTMENT OF DEFENSE U. S. ARMY ELECTRONICS COMMAND FORT MONMOUTH NEW JERSEY 07703	
MATERIAL: S.S.	PREPARED [signature] 24FEB 75 CHECKED ENGINEER [signature] 4 MAR 75	SUPPORT BRACKET	
		SIZE A	CODE IDENT NO. 80063
		DRAWING NO. SM-A-435968	
		SCALE 1/1	SHEET

-35953

APPLICATION		REVISIONS			
NEXT ASSY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
SM-D-435953	GRA/39B				

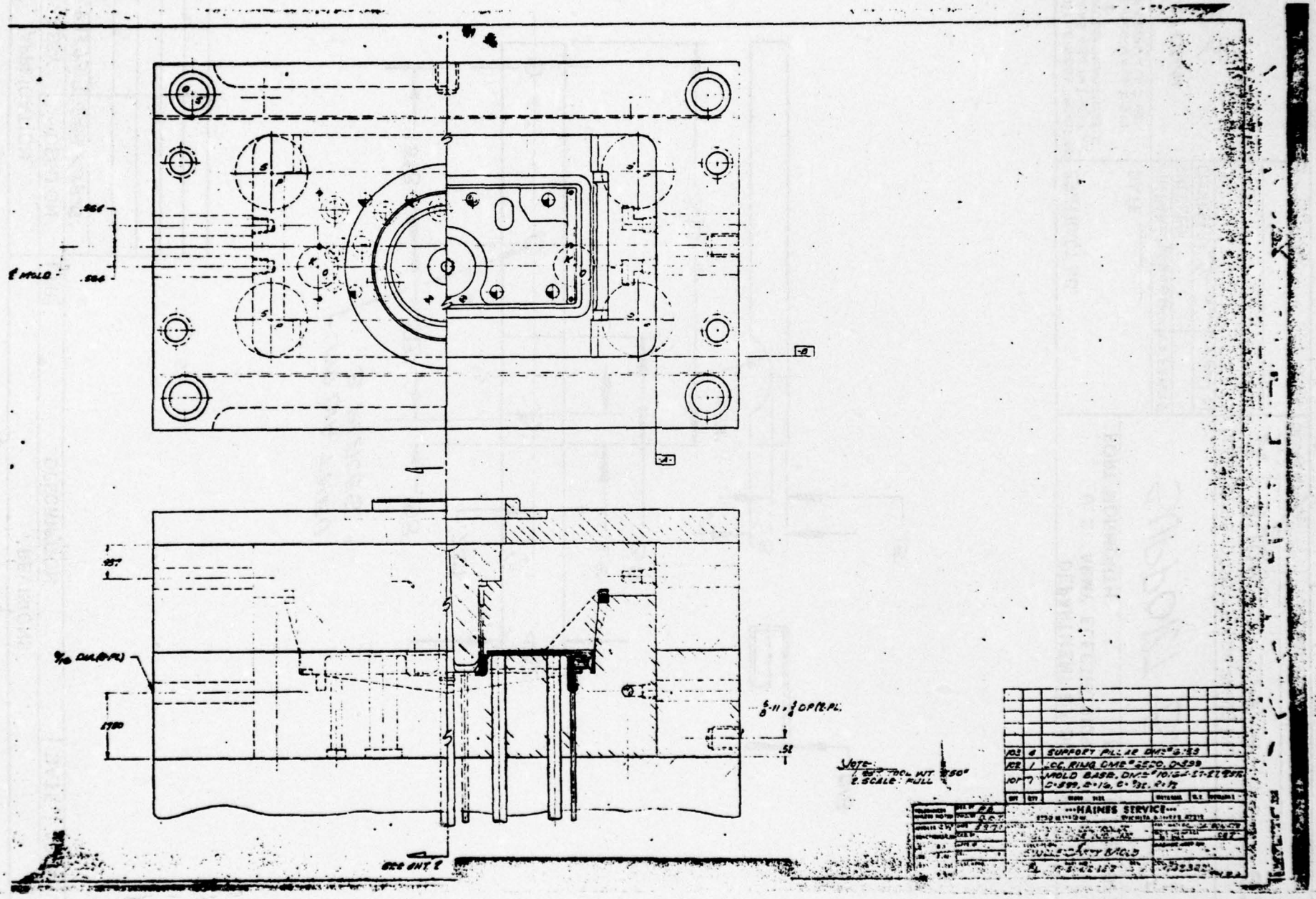


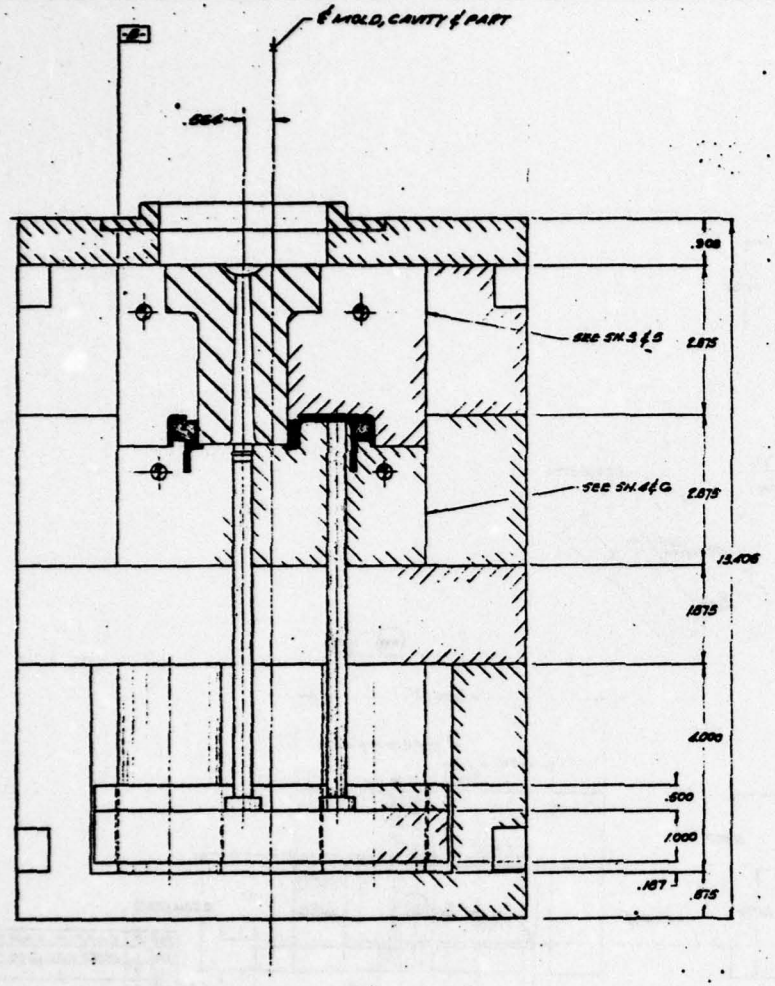
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONS ± ANGLES ± 3 PLACE DECIMALS ±.010 2 PLACE DECIMALS ±.03	CONTRACT NO. DATE	DEPARTMENT OF DEFENSE U. S. ARMY ELECTRONICS COMMAND FORT MONMOUTH NEW JERSEY 07703	
MATERIAL S. S.	PREPARED Bowden 24 FEB 75 CHECKED ENGINEER Gordon 4 MAR 75	SUPPORT BRACKET	
		SIZE A	CODE IDENT NO. 80063
		SCALE 1/1	SHEET

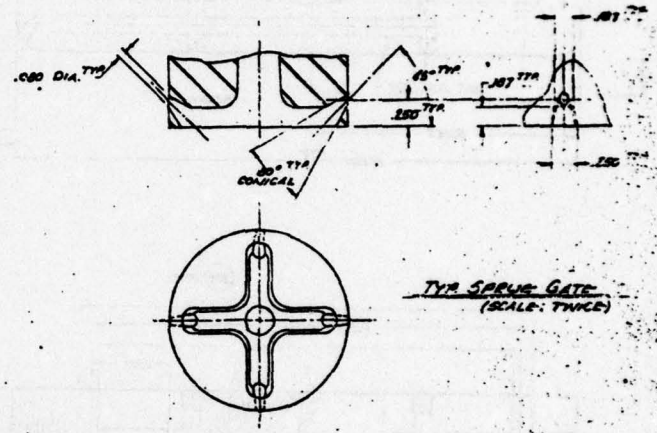
DRAWING NO. SM-A-435967

435960

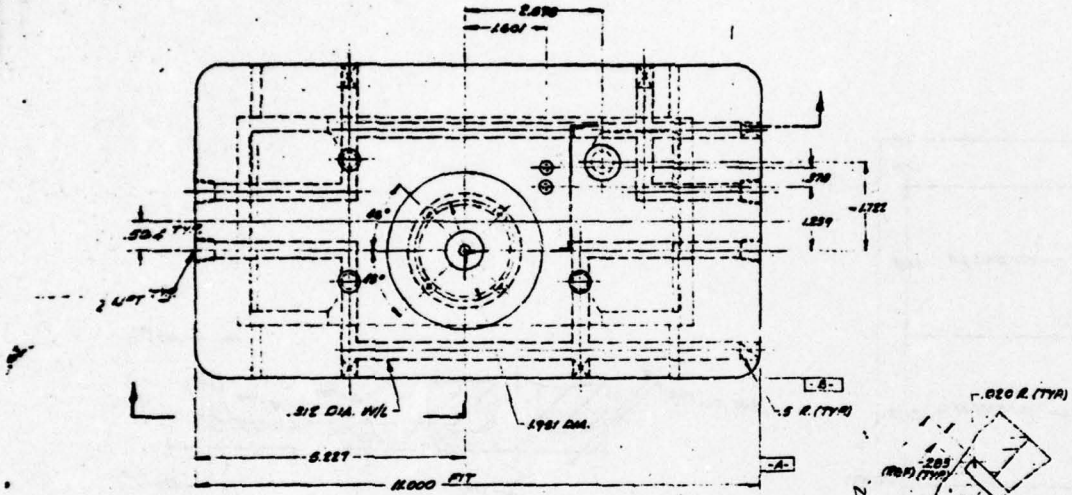
Single Cavity Mold Panel
19-31-412-1 & 2
Sheet 1 of 6

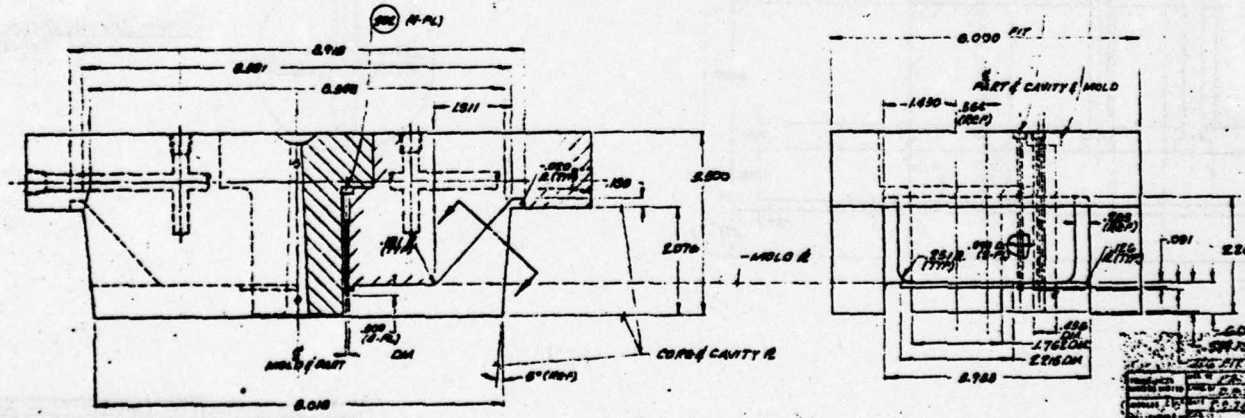






TYP SPRUE GATE
(SCALE: TWICE)



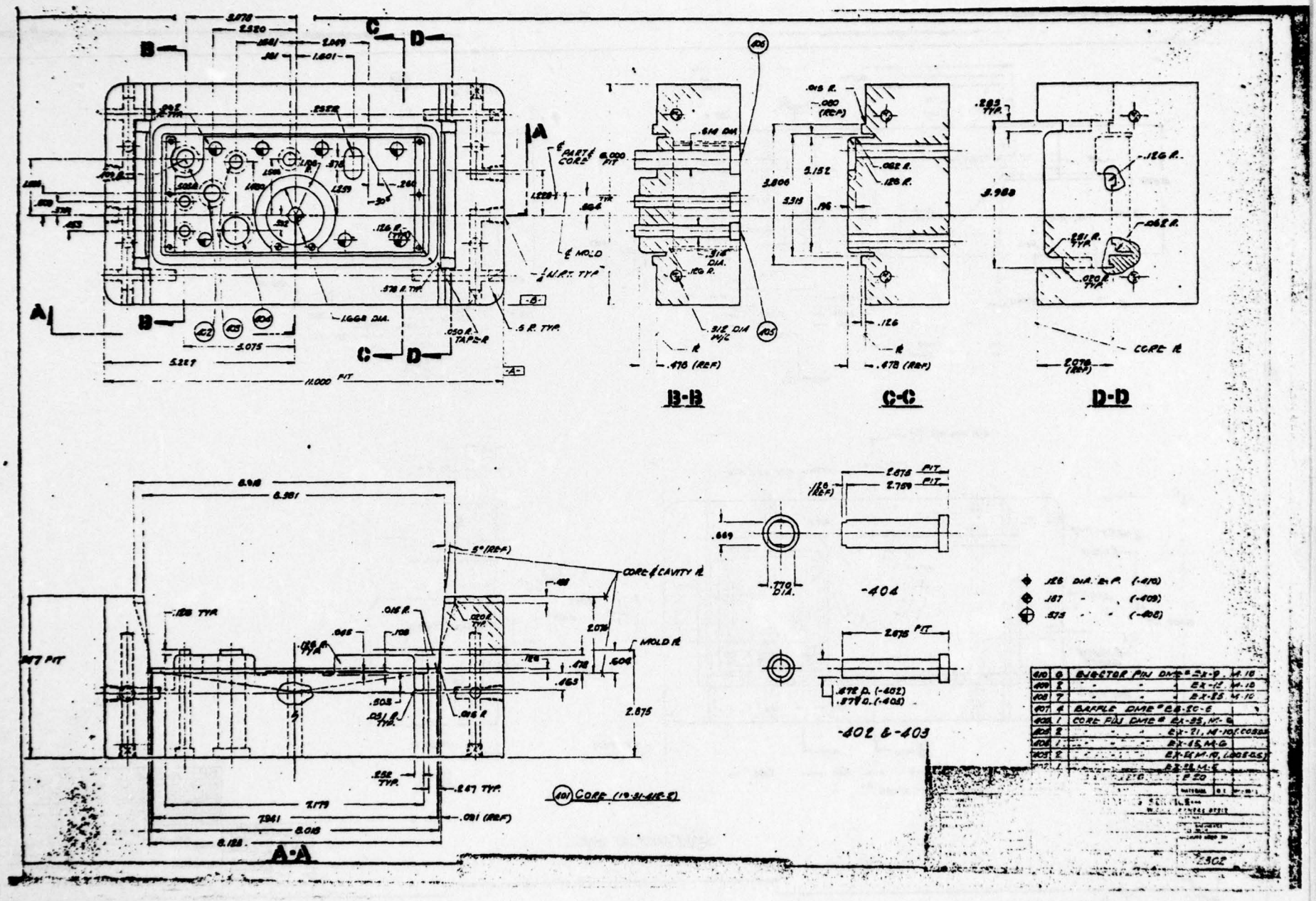


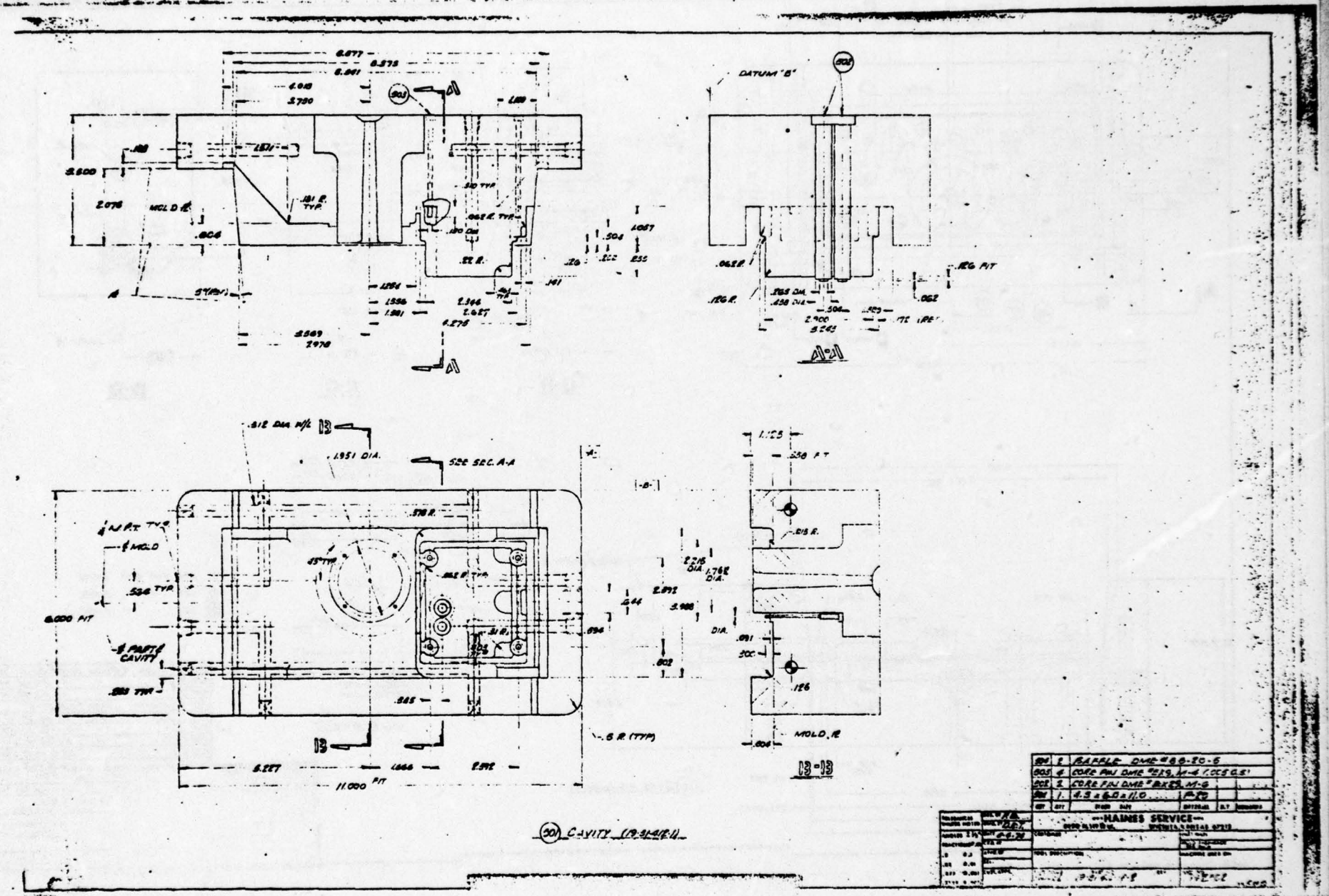
305	3	BAFFLE CHR "B"			
304	1	CORE PIN CHR "B"	P-21, M-6		
303	2	" " "	P-7, M-6		
302	4	" " "	P-8, M-6		
301	1	5x0.D.x I.C.	P-20		
QTY.	REQ'D	SIZE	MATERIAL	HEAT TREAT	REMARKS

HAINES SERVICE

302 (4-PL)

304 CAVITY (19-31-412-2)

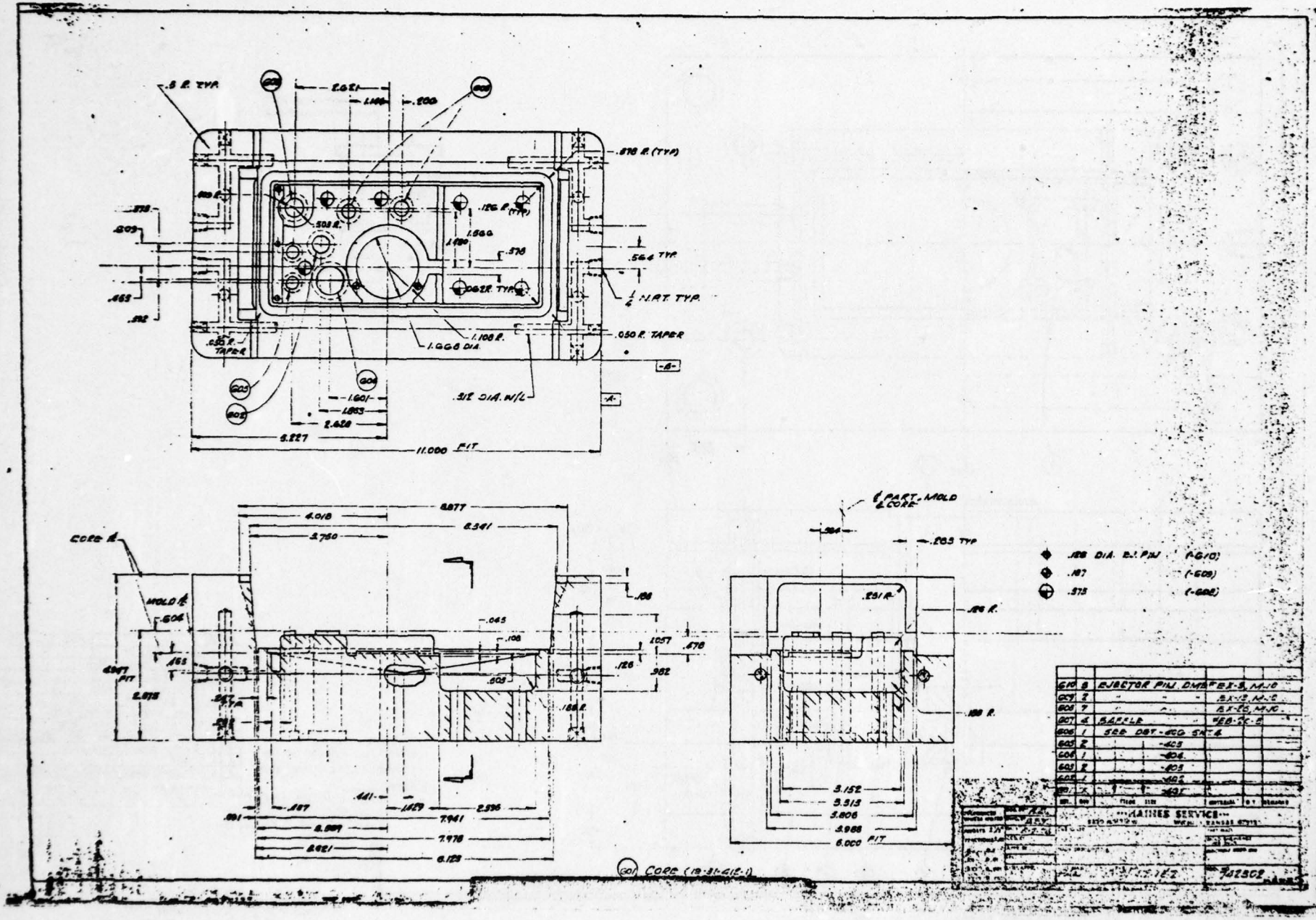

B-B
C-C
D-D
A-A
-401
-402 & -403
11.000 PIT
5.075
5.227
1.668 DIA.
.050 R. TAPER
.5 R. TYP.
.578 R. TYP.
PART ℄ CORE
6.000 PIT
℄ MOLD
℄ M.I.R. TYP.
.614 DIA.
.318 DIA.
.312 DIA M/C
.476 (REF.)
.478 (REF.)
.126
.062 R.
.126 R.
.281 R. TYP.
.020 R. TYP.
CORE ℄
.078 (REF.)
CORE ℄ CAVITY ℄
MOLD ℄
.126 TYP.
.015 R.
.220 TYP.
.503
.031 R. TYP.
.252 TYP.
.247 TYP.
.081 (REF.)
5° (REF.)
2.875 PIT
2.759 PIT
.669
.719 DIA.
.672 D. (-402)
.677 D. (-403)
.126 DIA. B.P. (-410)
.187 - - (-409)
.573 - - (-408)
(401) CORE (19-31-412-2)



(30) CAVITY (19-31-412-1)

904	2	BAFFLE DME #88-20-6			
905	4	CORE PIN DME #219, M-6 1.005 G.S.			
906	2	CORE PIN DME #8X25, M-6			
907	1	4.5 x 6.0 x 11.0	P-20		
QTY	DWG	PART NAME	MATERIAL	H.T.	REMARKS

HAINES SERVICE



ITEM	QTY	DESCRIPTION	MATERIAL
610	8	EJECTOR PIN, DME #EJ-8, M.O.	
609	2	" "	EX-12, M.O.
608	7	" "	EX-20, M.O.
607	4	BAFFLE	#EB-2C-2
606	1	SEE DET. -606 SHT. 4	
605	2	-605	
604	1	-604	
603	2	-603	
602	1	-602	
601	1	-601	

NO.	DATE	ITEM	DESCRIPTION	APPROVED	BY	CHECKED

REV.	DESCRIPTION	DATE	APPROVED

"JAMES" SERVICE

SCALE 1/2 | WEIGHT | SHEET 1 OF 2 | 722502

AD-A034 117 EAGLE-PICHER INDUSTRIES INC JOPLIN MO COUPLES DEPT F/G 17/2.1
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2 OF 2
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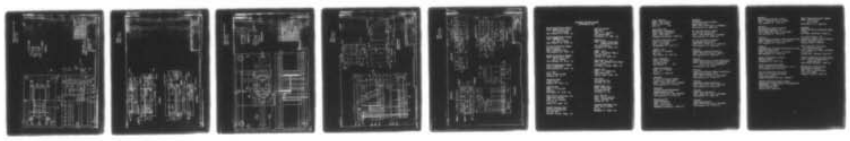

END

DATE
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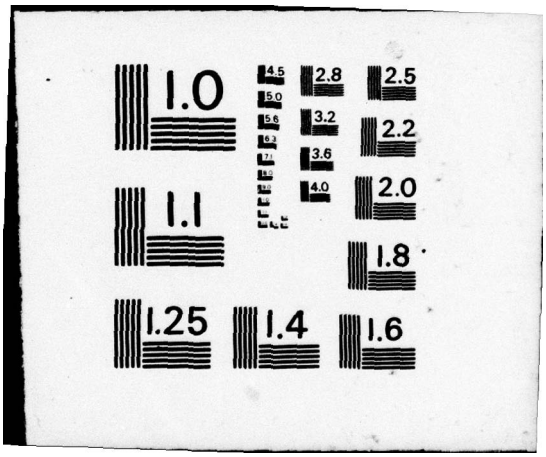
2 - 77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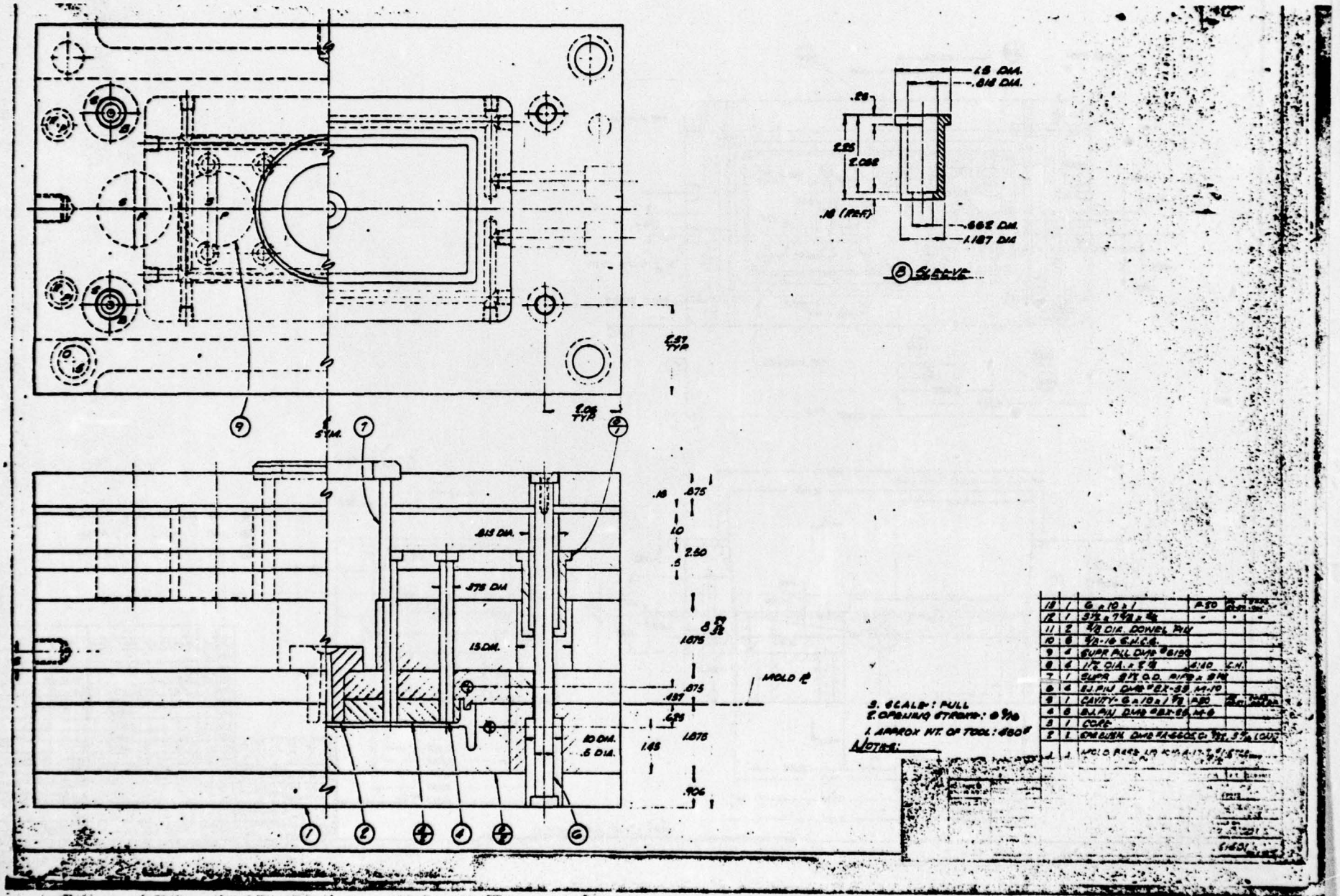
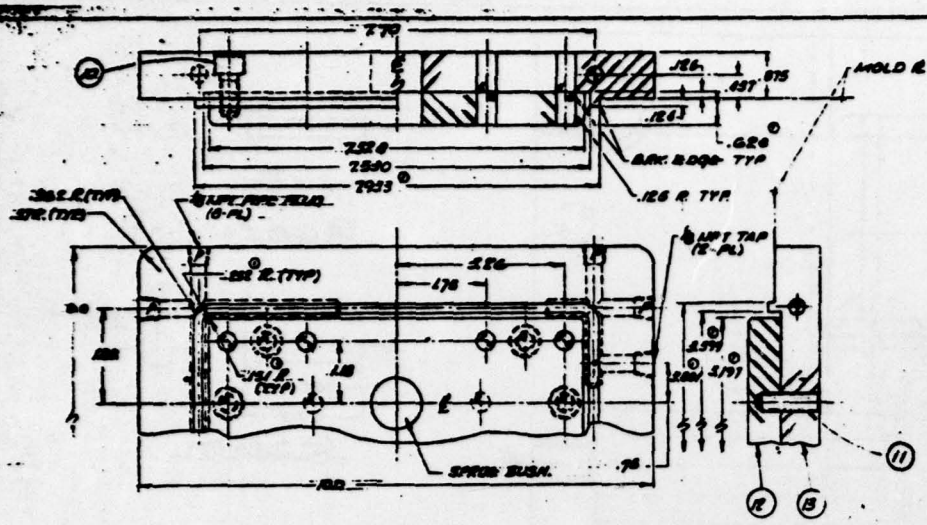
4.5
5.0
5.6

Single Cavity Mold Cover
19-31-412-3
Sheet 1 of 2





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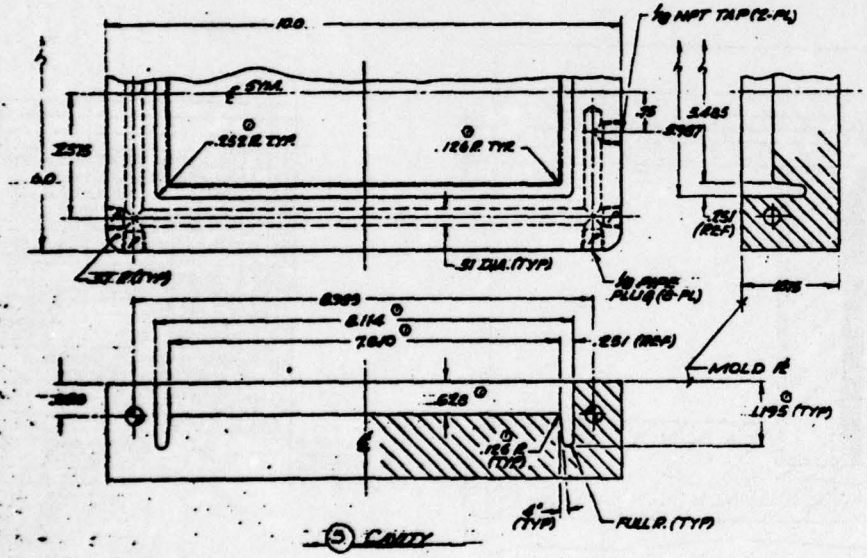
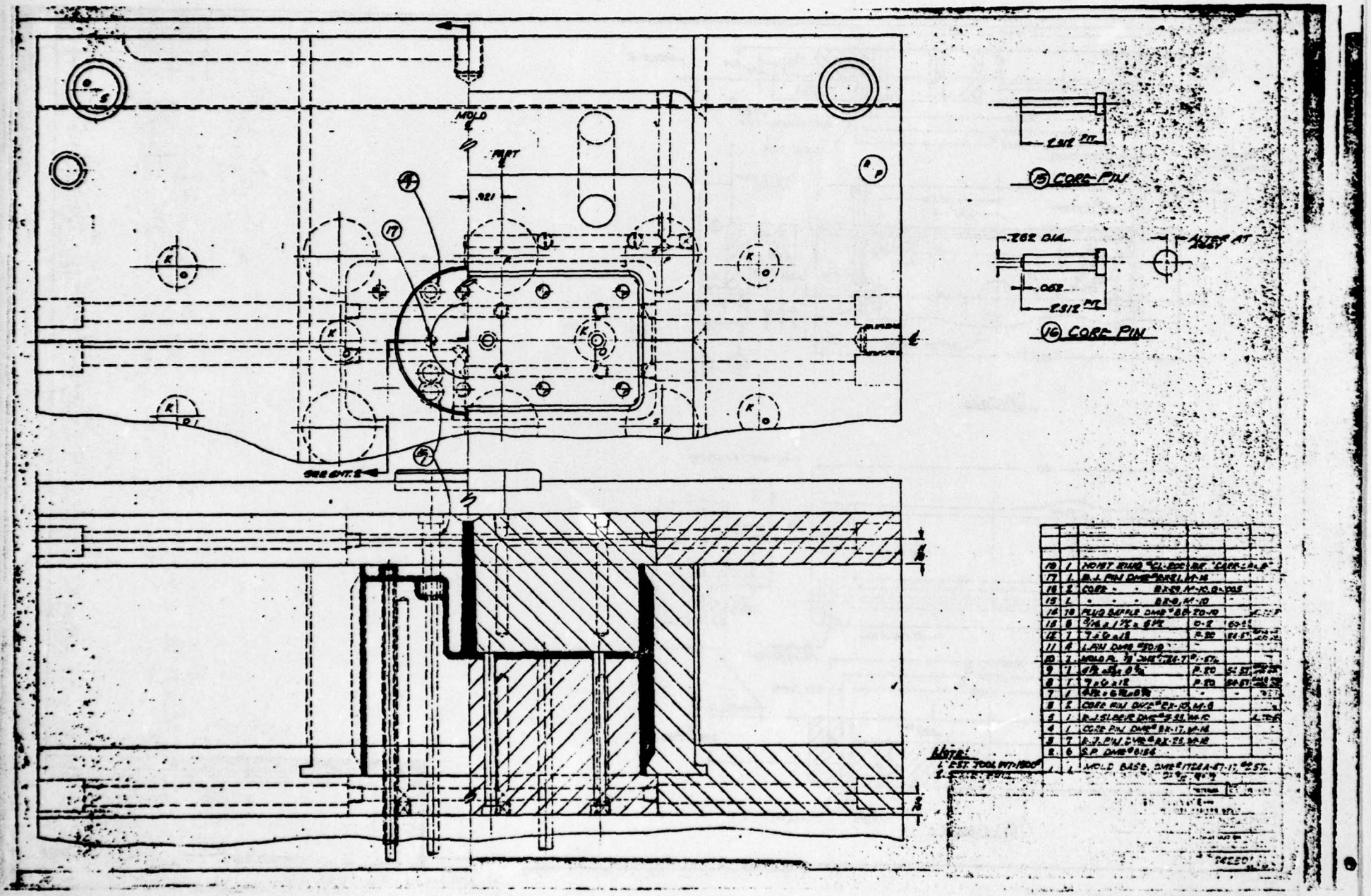


(5) CAVITY

Single Cavity Mold Case
19-31-412-0
Sheet 1 of 3



Case
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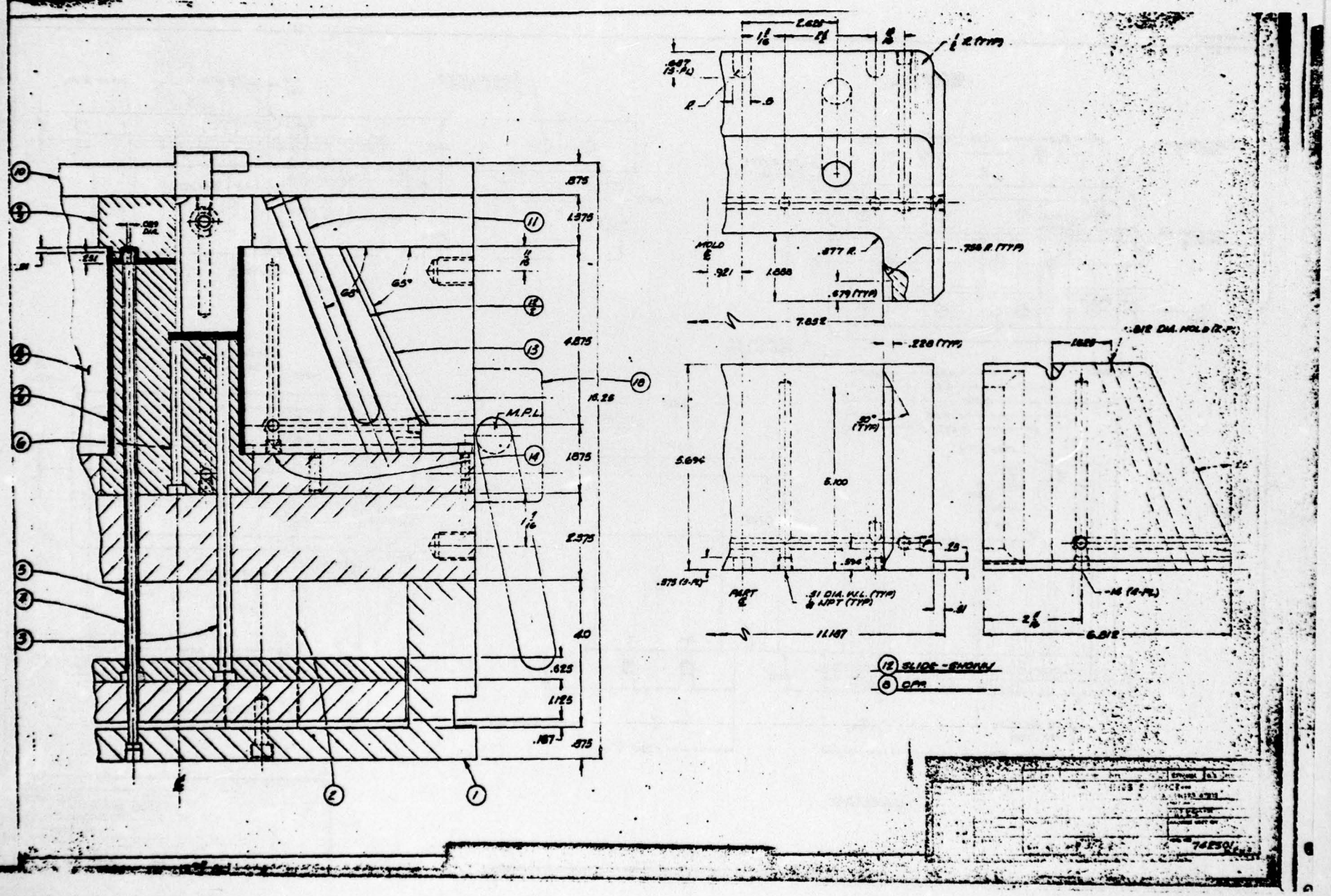
Sheet 2 of 3



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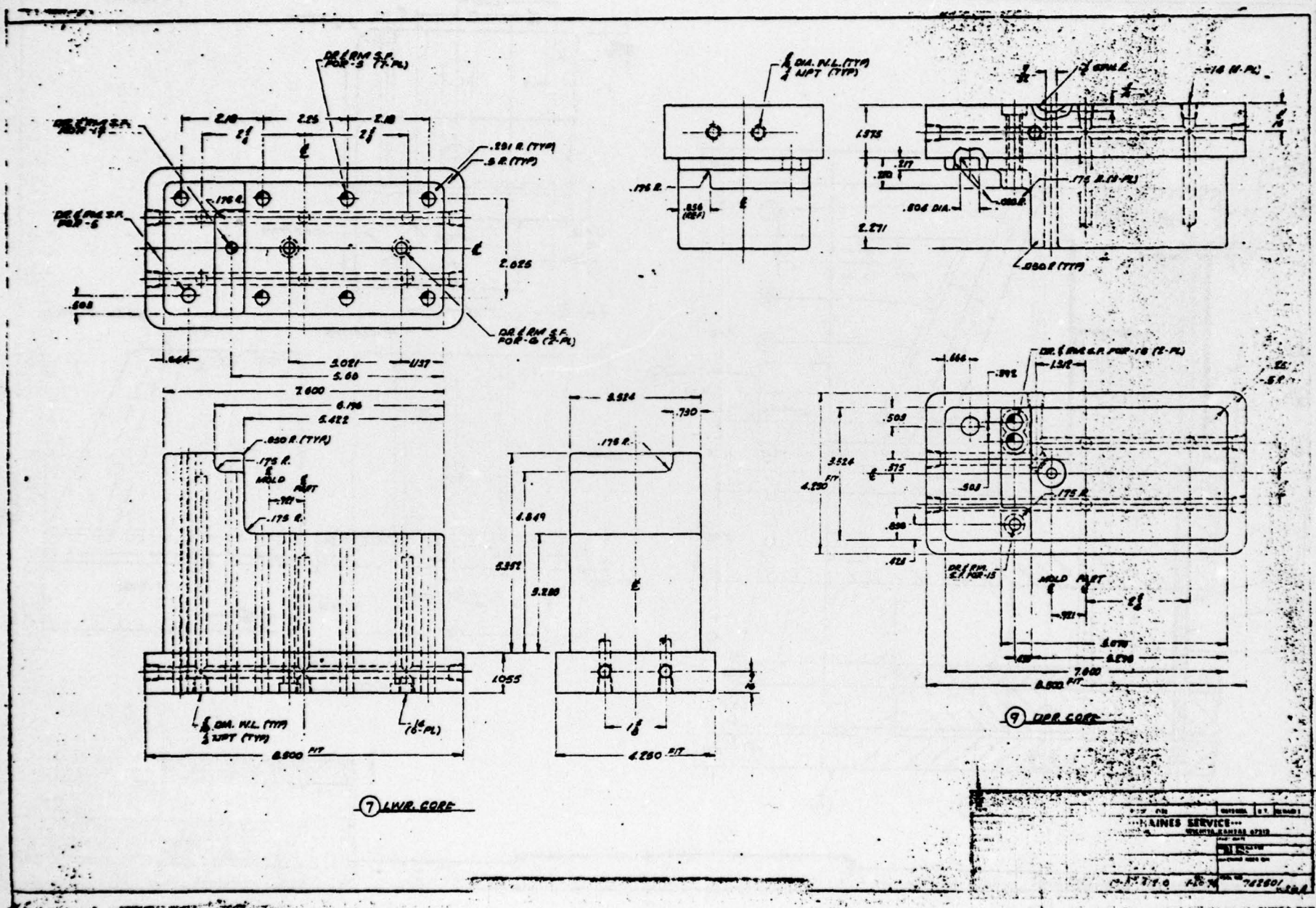
Sheet 3 of 3



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